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ADDRESS AT THE ANNIVERSARY GENERAL MEETING, 30 MAY 1921

Lt.-Col. Sir Francis Younghusband, K.C.S.I., K.C.I.E., President

THE main interest in the present session has centred round the arrangements for the Expedition to Mount Everest. And it is remarkable how wide is the interest taken, and how extensive are the preparations required. From this little island in the North Sea we have had to be negotiating, through the Viceroy of distant India, with the Grand Lama of still more distant Tibet for permission to explore a mountain which we have selected for our attention for the sole reason that it is the highest in the world. And we have no sooner obtained the Lama's permission and announced our intention of making an attempt to reach the mountain summit than applications come in from all over the world to be allowed to take part in the enterprise. From Japan and from Chicago, from France and New Zealand, from Norway, Italy, Hungary, and Greece, as well of course from our own country, applications keep steadily coming in. And from His Majesty the King and H.R.H. the Prince of Wales to working men subscriptions have been received.

But while there was this widely extended interest shown; while the Alpine Club with only some six hundred members subscribed over three thousand pounds; and while applicants were so keen that they said they were ready to go in any capacity; while, again, some were ready to contribute substantially to the expenses if they were allowed to go and those who were eventually selected regarded themselves as most privileged beings; yet there are still plenty of other men who are quite genuinely anxious to know what is the good of climbing Mount Everest. Thus a correspondent writes to a scientific paper: "Are the scientific results hoped for worth the trouble and the expense? Barring the view, what does any one expect to find at the top? Isn't it time that this kind of thing were looked upon by all decent people in the same light as attempts to reach the North and South Poles—namely, a pathological manifestation, or, in less technical language, a singularly futile waste of energy and good money?" There are even Fellows of our own Society who see no good in the enterprise, and even a lecturer on geography tells me that

knowledge of the exact temperature at which currants will grow is of more importance to geography than the knowledge that somebody or other has stood on the top of Mount Everest.

Now we can quite understand that every single human being cannot be boiling over with enthusiasm. There are such a multitude of interests in life that among them all there are only very few into which each of us can throw himself enthusiastically. But if only a comparatively few men can be expected to take an absorbing interest in the ascent of Mount Everest, *all* should appreciate its value and most assuredly no one—certainly not a geographer—should regard it as worthless. And as long as even Fellows of our Society are doubtful of its advantages I must go on preaching its value.

The knowledge of the temperature at which currants grow best would certainly enable us to grow more currants; one item of our food would be cheaper; and we would have pleasanter food to eat. Against this advantage the ascent of Mount Everest has no material gain to show. It would not even remotely contribute towards supplying us with cheaper or better food, or with any such materials as coal, iron, or gold, that we need in our daily life. There would be no material advantage whatever to be gained by climbing Mount Everest—nothing that can be weighed in the scales or valued in money.

And if we geographers spent our money, time, and energy in investigating the conditions under which currants grow instead of making attempts to climb a high mountain, no doubt humanity would ere long be able to have currants in their daily bread. But, as we were told long ago, man does not live by bread alone. After he has eaten his bread he wants to enjoy life. Enjoyment of life, not eating, is his chief end. And one of the enjoyments of life is mountain climbing. Last year, in my Presidential Address, I said that if Mount Everest were climbed at all it would be with no material advantage in view, but for the sheer love of the thing. Let me now explain in what the enjoyment lies.

Firstly, like all young animals—and mankind is still very young, though we are apt to think ourselves very old—we love to play about and exercise ourselves and test our capacities. Just like puppies or children, we like to pit ourselves against big obstacles and find out how far we can overcome them. We enjoy the play and exercise. And by it we get to know our capacities, and, what is more, get to increase and develop them. Under the leadership of De Saussure we tested ourselves against the highest mountain in Europe more than a century ago. Now we are going to test ourselves against the highest mountain in the world, and the testing is in its essence pure play and enjoyment—and enjoyment all the more thrilling because of the spice of danger it involves. This anyhow is the way in which those have now left England to try conclusions with Mount Everest regard it—and therein they show the authentic English spirit. They delight in having found an occasion which will call out the utmost of

their skill and power, and on which it will be really worth while putting forth the extreme of which they are capable. One of them, when told he had been selected for the expedition, said he was being sent to Heaven.

Then again, men enjoy being, or seeing or providing what is the absolutely best, and an enterprise like climbing the highest mountain necessitates the employment of the best in a hundred different directions. To everybody and everything connected with the expedition we have to apply the test, "Is he or it of the very best procurable or makeable?" We cannot say, "That is not quite the best, still it will do well enough." No second best or mediocrity will do. The Committee had to choose for the party who would be expected to climb highest, men in the perfect prime of life, in the finest physical condition and of proved skill and experience in mountaineering. They had, too, to be men who could be trusted to keep going when by day the rays of a tropical sun freely piercing the thin air were beating them down with sunstroke, and when at night cold of arctic intensity was threatening them with frostbite; when at any time they might be caught in blizzards which would cut into their very bones; and when, in face of hardships accumulating in severity the higher they reached, their vitality through lack of oxygen was being correspondingly reduced. Lastly, besides these high physical qualities and the grit and determination to hold on in such circumstances; besides, too, the nerve to keep steady when disaster can only be avoided by coolness and quick and right decision; they had also to possess in high degree the capacity for getting on with one another. At great heights men get very nervous and irritable. At 16,000 feet they begin to lose patience with one another, and the higher they climb the deeper they hate. A simple calculation will show what at 26,000 feet will be the intensity of their mutual repugnance. Yet it is at this point that they will have to be closest to each other, and most continually together. In order to economize in baggage, they will have to sleep together in the same sleeping-bag at night; and by day owing to the danger of the mountain slope they will have to be on a rope tied inseparably together. They will be in a highly irritable state, tired to extinction of one another, each longing for a moment's respite from the other, and yet they will have to disguise their true feelings, keep smiling, and above everything remain staunch and loyal to each other and to the object of all their efforts; for a flaw here, dissension at the supreme moment, would ruin the whole expedition. These are the qualities we had to look for in the climbers, and certainly nothing short of the best would do there.

Then for the command of the whole expedition we had to find a man who would conduct it so as to remove every obstacle in the way of the climbers, provide them with every procurable facility, transport them to the foot of the mountain in the fittest possible condition and with the least avoidable strain upon them, in order that when the time for saying

"Go" arrived they might start up the mountain in the finest fettle, and with the best prospects of success.

Now the expedition will have to march for more than 300 miles through Sikkim and Tibet before reaching the mountain itself. Most thorough arrangements for transporting the party and their equipment and for keeping them amply and well fed throughout their three months on the mountain will have to be made. And Tibet is inhabited by a very seclusive and independent people quite unaccustomed to the visits of scientific expeditions, so that special care is required to treat the inhabitants with delicacy and circumspection. We had therefore to find for the leadership of the expedition a man capable, not only of directing the supply and transport arrangements, but of properly handling the local inhabitants. In addition he had to possess the capacity for reconciling the clashing interests of different members of the expedition. On an expedition like this each member is terribly in earnest about his own particular job. Each quite rightly thinks that the expedition will be a failure unless he does his own job to perfection. And each very naturally thinks his own way of doing his own job is the only way to do it. Unfortunately, his own way of doing his own job may prevent some one else doing *his* job in his way. And then it is the clash comes. And then it is a chief is needed who will determine the right course and get his men to go along it cheerfully. In nearly every expedition there are violent conflicts of opinion due to sheer keenness to make the expedition a success. We have to assume that it will be the same with the Mount Everest Expedition—and indeed hope there may be continual sharp contests, for if there are none, if all the members are torpid and lacking in edge, the expedition will be wanting in that vim and go which are essential for its success. But if we anticipate and desire these sharp conflicts between individuals each intent on the success of his own special part of the whole expedition, we must also expect of the chief that he shall be capable of controlling all this zeal and of heading it steadily off in the right direction—which is the top of the mountain. He must therefore be capable on the one hand of limitless patience and broadest consideration, and on the other of the most authoritative and decisive command. He must have it in him, too, to give that final touch of grace and courtesy and humour which together form the very flower of leadership, and provide the balm to compose every difference and preserve undimmed that spirit of high endeavour which now animates every member. Otherwise honest conflicts will degenerate into vulgar dissensions, and the expedition will crumple up ignominiously and be a disgrace to our country. The chief also has therefore to be the very best man we can obtain.

And so it runs all through the arrangements for the expedition. In every particular we have had to be on the look-out for the best. The very mules have been specially selected, and their equipment subjected to particular inspections under the direct orders of Lord Rawlinson, the

Commander-in-Chief. Mr. Goode, the Deputy Commissioner at Darjeeling, has been for two months past looking out for the steadiest men to enlist in the special corps of Himalayan porters which has been raised. Here in England, with the assistance and advice of General Bruce, Mr. C. F. Meade, and Captain Farrar, we have got together the best mountaineering equipment, tents, clothing, sleeping-bags, boots, ice-axes, ropes, etc., and the best provisions for high camps it is possible to secure. Colonel Jack and Mr. Hinks have paid like keen attention to the instrumental outfit—cameras, binoculars, compasses, aneroids, thermometers, etc. Naturally these gentlemen sought out the best firms for the supply of these articles, and the firms themselves went out of their way to see that each article was of the very best they could turn out, and if it was possible to improve upon this best they did. Finally, every instrument was well tested in the National Physical Laboratory.

In every particular of the expedition, from the highest climbers to the nails on their boots and the mules which will carry their food and equipment into Tibet, there has been effort to get the best. The preliminaries have been carried out in an atmosphere of high excellence. And because there has to be this intense striving for the best, men *enjoy* taking part in the expedition. Men of science like Prof. Collie and of business like Captain Farrar, with none too much time to spare, have been ready to spend hours and hours in finding out good men, in purchasing and testing equipment, and in persuading their friends to contribute to the expedition—and all this for no material gain whatever—quite the contrary, for they have themselves contributed most generously to the funds—but for the pure love of helping forward something which they are convinced is supremely worth while.

This enjoyment in high effort which all have who take part in the expedition—even those who know the fearful hardships they themselves will have to endure—is one good to be obtained from attempting to climb Mount Everest. Another good will be obtained when our hopes are achieved, and that is the raising of the standard of achievement. When climbing other mountains men will remind themselves that men have conquered the highest, and will with higher courage and firmer will set about climbing those seventy other Himalayan peaks which rise over 24,000 feet above the sea, and still remain unvanquished, as well as those 1100 peaks over 20,000 feet of which only a score or so have yet been scaled. And the ascent of Mount Everest, when it has been made, will raise the standard of achievement in many another field than mountaineering. The conquest of that highest mountain, the story of how the spirit of man surmounted every material obstacle, bore up amidst every physical hardship, and carried his unwilling body to the summit of the world, will hearten men in every land and in every occupation, and stir them also to rise triumphant over all impediments which confront them.

One final—and the chief—good remains. As men test and exercise

and develop their capacities and heighten their standard of achievement, they will come to feel more at home among great mountains, and more freely enter into their high spirit. And as they come to know and understand the mountains better, the greater beauty will they see. Enjoyment of their austere majestic beauty will increase among men, and be not the least of the many enjoyments of their lives.

So, if there is no material advantage to be gained by climbing Mount Everest, there is much spiritual good to be found. And whatever we geographers can do, by pioneering the way among the mountains, to add to the enjoyments of life is surely as well worth while as what we are accustomed to do towards adding to the purely material prosperity of mankind.

One concluding observation is necessary. Success will only be achieved by a rare combination of individual and social effort. A single individual could not possibly succeed. A man cannot run up Mount Everest as he runs up Ben Nevis. Organization is required; and the individual who makes the attempt to reach the summit will at every turn be dependent on the efficiency and smooth working of that organization. We have therefore endeavoured to make the organization as complete and perfect as we can. Our own Society has joined with another great voluntary association, the Alpine Club, and combining our influence and experience with the aid of the State, both here and in India, we have sought to help the individual to achieve what without this help would be beyond his means. But much as the individual must depend on the organization, he must still depend upon himself—and depend upon himself *more* than upon the organization. Organization must not defeat its own end. It must not heavily bear down the individual. It must help him. The individual must have all the advantage of powerful organization behind him, but be able to preserve all his go and spirit and initiative and resource. Otherwise he will not reach the summit.

Some indeed are of opinion that the organization of the present expedition is on *too* big a scale—that the party is too large, and too much money is being spent. If the expedition were on a humbler, simpler scale—composed of just two or three men going off in quite a small way with a few local inhabitants, there would be a greater chance. The weight of experience is against this view. The *passes* in the Himalaya have been explored in this way, and Survey officers have scaled many of the minor peaks. But the supreme peak is not so easily vanquished. For the conquest of the proud monarch of them all a mightier effort is needed. Many men must combine together for the assault. Considerable expeditions have already attacked 24,000-feet peaks, but only one of them has been successful. Now in one jump we are attempting a peak 5000 feet higher still—and attempting it without Swiss guides like other parties have had—so we would have been foolish indeed to attempt Mount Everest with any smaller party than the present.

The expedition is, we believe, fitly and adequately equipped and organ-

ized for the purpose in view—for pushing a reconnaissance well up the mountain this year, and for prospecting the way for an all-out effort to reach the summit next year. We have tried to do all we can for the climbers. We must now depend on them—upon Mallory, Bullock, and Kellas to push highest up the mountain, upon Raeburn, the veteran mountaineer, to guide their activities aright, upon Morshead and Wheeler to conduct the survey with accuracy and efficiency, upon Wollaston to look after the health and well-being of the whole party, and upon Howard-Bury to co-ordinate all the activities and persistently direct them to the appointed goal. Their progress will be reported to us by cablegram from time to time, and watchers in every land will follow the slow unfolding of the drama as man closes in mortal struggle with the mountain for the final mastery of the planet. Is the supreme mountain to be supreme over man, or is man to be supreme over the mountain? This is the momentous issue which now awaits decision.

But we are not content with scaling mountains: at our afternoon meetings we have been interesting ourselves in their origin. Geologists had long taught us that mountain ranges arose through compression of the Earth's crust in its process of cooling. But this theory has been disputed by Sir Sidney Burrard and Colonel Tandy in papers read before this Society. Not to compression, but to physical and chemical changes in the very varied descriptions of rocks which compose the crust would Sir Sidney Burrard attribute the elevation of mountains. And Colonel Tandy further develops views on Isostasy, the principle by which excess of density in one portion of the crust, for example under river deltas, is compensated for by diminution of density under another portion, for example under mountains.

At these afternoon meetings where we expect to have fruitful discussions on technical subjects we heard a particularly interesting paper on the Chronometer by Commander Gould; while at another meeting Mr. Heawood reminded us, on the fourth centenary of the circumnavigator's death, of the debt cartography owes to Magellan.

At our evening meetings we have been chiefly dependent on officers who have been good enough to give us their experiences in distant fields in the Great War. Colonel Bailey related to us some of his extraordinary adventures while evading the activities of the Bolsheviks in Central Asia. General Dunsterville with much graphic power told of his daring expedition from Mesopotamia to the Caspian Sea. The little-visited southern shores of that sea were described by Captain Noel. Sir Percy Sykes gave us an account of his long and bold marches through Southern Persia. And Captain Blacker carried us to the Roof of the World and to a region up on the upper waters of the Yarkand River which had never been explored before, but through which he had unfortunately to travel so rapidly that there was little time or opportunity for accurate mapping.

Besides these accounts of experiences during the war, we have had a paper containing much valuable geographical information of the upper reaches of the Orinoco by the well-known and most thorough and methodical American traveller, Dr. Hamilton Rice; and a singularly graphic account of the lower reaches of the Orange River by Mr. Cornell, whose death by accident we have since deplored. Mr. Debenham also gave us a convincing description of the value of Polar exploration. Lastly, a week ago we had an exceptionally well-delivered account from Mrs. Rosita Forbes of her adventurous journey across the Libyan Desert to Kufara, which had only once before been reached by Europeans.

A branch of our activities which is carried on beyond the notice of most of our Fellows is the instruction in surveying by Mr. Reeves. The Colonial Office is now sending classes of sixty or more young officials to acquire an elementary knowledge of map-making, so that they may be able roughly to delineate the features of unsurveyed regions into which their official duties may carry them. By this means and by the instruction of private travellers much is being done to add to our geographical knowledge.

With the increased cost of everything, and with the consequent need of increasing the salaries of our staff, we have found it difficult to continue the grants to Oxford and Cambridge Universities for Geographical Lectureships. But rather than allow geographical work there to slacken through lack of support from us we have cut down expenditure elsewhere and continued a somewhat diminished grant for another three years, by which time we hope that the University Schools will need no further help.

In these various directions we have endeavoured during the year to carry out the objects of our Society, which is the diffusion of geographical knowledge.

MOUNT KENYA

The Rev. J. W. Arthur, M.D.

Read at the Meeting of the Society, 7 February 1921.

TO reach Mount Kenya from Nairobi we travel by motor over a fine road to Thika, a distance of 30 miles; or there is a branch railway from Nairobi to Thika, which taps the farms between these places, and also supplies the settled area between Thika and Fort Hall, and that of Nyerí and beyond. From Thika to Fort Hall, a distance of 28 miles, the road is almost always bad, owing to heavy ox traffic; during the rains it is a mud quagmire, and in the dry season is covered with a layer of fine dust about a foot thick.

From Fort Hall we pass into an entirely native area, which is served by two main roads: one crosses the Tana River and goes round the east

side of Mount Kenya, through the Government posts of Embu and Chuka, to that of Meru, about 130 miles from Fort Hall. This is a superb piece of country, on the lower slopes of Mount Kenya, well watered by its numerous lovely streams, and extensively cultivated by a large Kikuyu native population. There are no European settled areas in all this region. The other main road proceeds from Fort Hall to Nyeri, a distance of 40 miles, and this too passes through entirely native areas, thickly populated and well cultivated. At Nyeri are the headquarters of the province, where the Provincial Commissioner with his staff is stationed. It is a healthy, beautiful place, about 6000 feet above sea, between the Kinangop range and Mount Kenya. It is the centre of the West Kenya and Laikipia European farms, which go out from it north-westwards, and near it eventually will pass the extension of the Thika railway, which is to be built out to Laikipia.

These farms are in beautiful country, healthy, and on the whole well watered; but they are somewhat handicapped by the fact that there are no native reserves near, and there is an absence of railway transport. These farms are mostly engaged in rearing high-grade cattle and sheep, but are also going in for coffee and flax. It is an area full of great promise, and is one of the main areas in which the soldier settlers have been allotted their farms. The Native Reserve extends from the other side of Nyeri round the southern and eastern sides of the mountain to Meru, which is on its north-east side. The Tana River, which passes through the heart of the Nyeri and Fort Hall Districts, takes its origin on the one hand from the Gura, Chania, and Thika rivers coming off the Kinangop range, and on the other from the small Tana River with its numerous tributaries from Mount Kenya itself.

The history of Mount Kenya is somewhat limited. The fact that two snow-capped mountains, Kenya and Kilimanjaro, existed in East Africa has been known for seventy years. It was on 3 December 1849 that Dr. Krapf saw the peak of Kenya through a rift in the clouds from Kitui, a distance of 90 miles, and although he stayed there for some weeks longer he did not see it again. This brief vision of a few minutes at sunset was all the evidence of its existence, until Joseph Thomson crossing the Laikipia plateau in 1883 saw on several occasions its western face and thus verified Krapf's highly discredited story. Count Teleki was the first to attempt an ascent of the mountain in 1887. He penetrated the forest and gained the open "alp" above, reaching an altitude of almost 14,000 feet. Owing to the sufferings of his porters and food shortage he had to return when only a few hundred feet below the snows. Mr. Piggott saw the face of the mountain in 1889, and Messrs. Dundas, Bird, Thompson and Hobley made an attempt the same year from the south, but were unable to penetrate the forest belt. Dr. Peters passed near Kenya in 1889–90 on his way to relieve Emin Pasha. It was left to Prof. Gregory to be the first man to set foot on the snows of Kenya, when in 1893 he

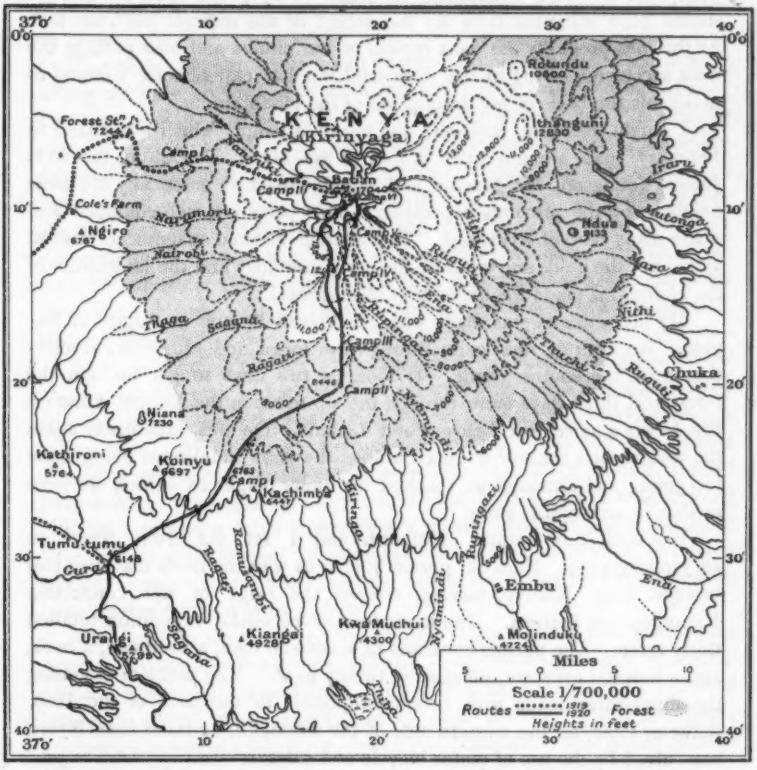
reached an altitude of about 16,000 feet, spending some hours on the Lewis glacier. He found himself obliged to do the snow-work entirely alone, because his boy Fundi refused to wear boots. The first and only ascent to the summit was made by Mr., now Sir Halford, Mackinder in 1899. He spent about a month together with Mr. Hausburg and four other Europeans surveying and exploring the valleys and glaciers, and collecting specimens; at last, after two unsuccessful attempts, on September 13 of that year, he with his two Swiss guides César and Joseph was able to set foot on Batian, the higher of the twin peaks.

The difficulties with which these earlier explorers were faced were indeed formidable, not only from the want of knowledge of the climatic conditions of the mountain, but also from the unsettled state of the native tribes, who were engaged in constant inter-tribal warfare, making it dangerous for Europeans to intrude into their country. Since the ascent of Mr. Mackinder in 1899 the peak Batian has never again been scaled, while the lower peak Nelion still waits to be conquered. A few expeditions, however, have been made reaching the snowfields. In 1908 Mr. Macgregor Ross, who was accompanying Mr. Hutchins, Conservator of Forests, in a survey of the forest regions, hurried up on two occasions. In the same year Mr. Kermit Roosevelt and some others made a trip reaching the glaciers, while later Mr. Sandbach Baker a forest officer, also succeeded in doing so.

It is difficult to know from what source the name Kenya has come. Prof. Gregory states that it was due to a misunderstanding. Some have thought that it is either a Masai or a Kikamba word meaning "mist," but there is no definite authority for this. The Kikuyu who live on the slopes of the mountain would seem to have the most right to give the name to it. They know it by two names, Kirinyaga and Kirimara. Kirinyaga in the Kikuyu language means "it is wonderful." The word *Nyaga* is also used by them in reference to God, whom they speak of as *Mwene Nyaga*, which means "He Himself is wonderful." The other name Kirimara means "it is spotted," in reference to the black appearance of the peak and its surrounding crags, speckled with snow and glacier. According to Prof. Gregory the Masai call it Donyo Ebor, meaning "the white mountain," and the Wanderobo Donyo Egeri, "the spotted mountain." The Kikamba name is the same as that for Kilimanjaro, namely, Njaro. The Zanzibari call it Meru. There is a Mount Meru to the south of Kilimanjaro, and the Meru, a sub-section of the Kikuyu, live on the north-eastern slopes of Kenya. The Kikuyu word *eru* with its various noun prefixes means "white." The Kikuyu have a third name, Githuri, in reference to the mountain, which I heard only during our last expedition; it is a name applied to any hill, and simply means "an old hill."

In March 1909 Mr. Barlow and I made our first attempt on Kenya. It is a mountain 17,040 feet high that stands out of the middle of a high plateau, itself averaging about 6000 feet, and therefore involves a climb

from the plateau of over 11,000 feet. The bulk of the mountain can be properly comprehended only by an attempt to scale it. Mr. Barlow and myself without any previous knowledge of the difficulties thought that it would be comparatively easy to reach the snows and probably to climb the peak itself. Looking back now, with the experience gained, we see how little prepared we were for what is a very difficult piece of work. We left the Western Forest station one morning at eight o'clock, proceeded



Sketch-map of Mount Kenya and neighbourhood from the G.S.G.S. map 1/250,000, with additions and corrections.

through the forest, and got out on to the alp from the bamboo forest by one o'clock, where we camped for the night. Next day we reached the snows, and then returned the third day to the Forest station.

The second expedition was with Mr. Barlow and Mr. Dennis in February 1916. We took a different route from that of our first attempt, and approached the peak by the eastern side. On the fifth day we made our final attempt to reach the summit, and reached Point Lenana—at

16,300 feet. We crossed the Lewis glacier to the base of the main peak, but failed to accomplish the remaining 1000 feet of sheer cliff. Our way back was down one of the finest of Kenya's valleys, the Gorges, in the upper part of which lies Lake Michaelson, and in which the Nithi river flows to and eventually passes between the countries of Chuka and Mwimbi.

A third attempt was made with Mr. J. D. Melhuish in February 1919. This time we were determined to make every preparation so that we should have sufficient time for the ascent of the difficult last 1000 feet. As this was probably the most typical of our climbs and also perhaps the most successful, owing to the wonderful weather experienced, I intend to make this the basis of my description of the mountain.

I might mention, however, our fourth attempt, which was made in February 1920, when a party of four of us—Mr. J. T. Oulton, the Rev. James Youngson, Mr. Machin and myself—reached practically the same height as on the previous expedition. This party was well equipped and made many new observations. The weather allowed magnificent distant views, but the cold and wind of the early mornings and the hailstorms of the afternoons made the expedition unsuccessful.

My fifth attempt was made with Sir Fowell Buxton in August of last year. An entirely new route through the forest and alps was chosen—that from the southern side. It took us two days to get through the forest and three days more through the alp to reach the Curling Pond on the Lewis glacier, just below Point Lenana. On this expedition again the weather was somewhat unfavourable, the snow conditions being none too good; and although we reached the same height as before, we were unable to accomplish more.

We shall now return. Melhuish and I set out from Nyeri on 28 January 1919. Here our porters joined us with the loads that they had brought from Kikuyu, having crossed the ridge of hill connecting Kinangop and Sattima. The loads for a three weeks' expedition totalled thirty-three. The porters consisted of seventeen men, a headman, a cook, and a hospital assistant, numbering twenty in all. The problem of getting the thirty-three loads with seventeen porters to the farm of the Hon. Berkeley Cole, on the western side of the mountain, 22 miles from Nyeri, was solved by the use of motor bicycle and sidecar.

During this period of the year, in the morning and evening the wind blows away from the peak, and in the evening the mountain usually clears, remains clear all night, and is clear in the early morning, sometimes as late as eleven o'clock or even later; but only on very rare occasions does it remain clear the whole of the day. During the day it is almost invariably covered in its upper regions from nine on till four with a thick layer of clouds.

Mr. Cole's farm was the limit of our motor transport, and thereafter everything had to be done by porters. The problem was still with us as to

carrying more loads than we had porters for. Our next camp, at the West Forest station about 10 miles further on, was to form our base camp at the foot of the mountain. We arranged that the porters should set off with full loads, but on reaching halfway half of them should return to pick up another lot of loads and then carry them straight through. The other half went on to the Forest station, returned in the afternoon for the loads left halfway by the first section, and carried them on. Thus we were enabled to convey twenty-five loads to our base camp. At the Forest station we were provided with a native forest guard to help us through the forest out on to the open alp.

The peak from this western side is seen end on as a single sharp peak, falling abruptly on each side to where there is a small lateral aiguille. The best view is from the south, from which the whole long ridge running east and west is visible. The journey through the forest after leaving the station is surpassingly beautiful, with cedars to the height of 100 to 150 feet and a girth up to 37 feet. The rivers flowing through the wood are very fine and add much to the beauty of the scenery. There are numerous elephant tracks through the forest. At 2 o'clock we came to one of the main tributaries of the Wanguthiru, and at 5.45 we pitched our camp for the night. We had a couple of good tents for the boys and a single 40-lb. tent for ourselves.

Next morning (February 1) we started early, passing through Podocarpus and bamboo, which were covered with numerous lianas and other climbing plants, while the beard moss (*Usnea*) was thick upon the branches of the trees. By twelve we were out of the bamboos, and then passed through a strip of giant heaths, the arborescent form of the "lady's mantle" (*Achemilla*). We began also to get into tussock grass, which makes going difficult, and among other plants we saw clover, dandelion, and gladiolus. The tussock grass is most inflammable, and a fire once started will often spread for miles; these fires, however, are prevented by the bamboos from entering the valuable forest below.

On the open alp we found, beside the tussock grass, two plants very typical of these regions—the *Lobelia Gregoriana* and the groundsel (*Senecio Kenyensis*). The lobelia grows upon the ground, with upturned leaves in which water collects and at night freezes. From the centre proceeds a flower of a blue-grey, feathery appearance. The plants grow to a height of from 8 to 14 feet. After they have flowered and died the hardened stem, a hollow core of wood, makes quite good firewood. The groundsel, however, is by far the better firewood of the two. It grows often to a height of 25 or 30 feet, and may be a foot or more in diameter. On this stump may be seen a head of green leaves, with a yellow flower. It usually, however, branches about 10 feet up, and on the top of each branch may be seen the same formation. Even though these leaves are green, the stem of the tree will burn, but the old dead plants which are scattered all over the valleys and ridges make the best firewood. It is

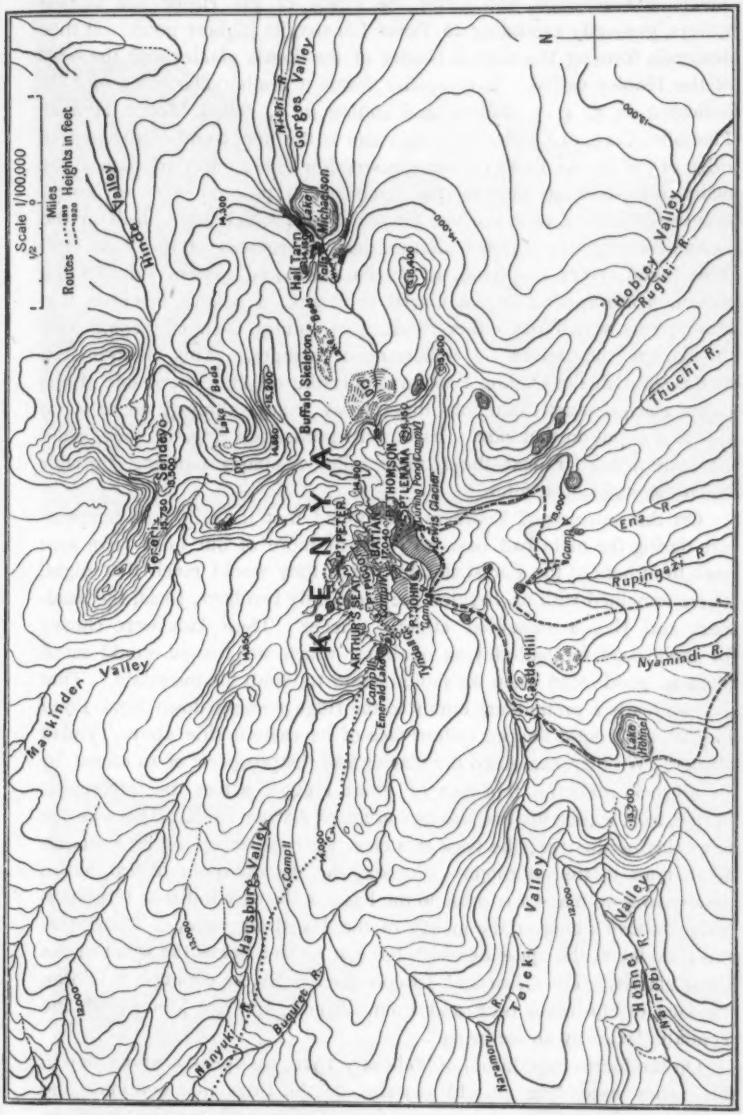
very fortunate that both lobelia and groundsel reach practically to the snow-level, and thus an abundance of firewood is always assured.

We made our second camp at 5.10 p.m. under the shelter of some rocks and near the small Gwathunanyuki stream. This was our first night of frost, and the boys were much interested in seeing ice next morning on our washhand basin and in the river-bed. The hospital boy and six porters with the two guides went back to the Forest station to bring up supplies; the rest of us set off about eleven with as many loads as we could take, leaving a few at the camp under a ledge of rock. We were now beginning to feel the altitude, and had to go very slowly. Here we began to see the first signs of the coney or rock rabbit (*Procavia*); two varieties of these hyrax are found on the mountain. There is the ordinary tree hyrax (*Procavia shoana*), which is heard every night in the forest regions below uttering its shrill piercing cry, while on the open alp, and especially in the rock regions round the peak, is found the lighter-coloured variety known as the rock rabbit.

At 2.40 the mist cleared for a little and gave us a beautiful sight of the peak looming up before us. A little afterwards we came to the head of the Gwathunanyuki river and valley, and after crossing a ridge, entered the valley that Barlow and I had ascended in 1909. Keeping up the ridge to the north of this valley, we eventually got above some crags at its head. A short distance further we found ourselves on the northern ridge of the great Hausburg valley. We then descended into its upper southern source, and made Camp III. just below the beautiful Emerald Lake at the base of Arthur's Seat. The tussock grass had now ceased and given place to a soft gravelly moraine. This formed our base camp till Friday February 7. It was not an ideal camp for a base, as it was too far away from our main operations, but we had to put up with it till the porters returned from the Forest station. In the evening as usual the mist dispersed, and the great mass of the peak, cold and clear, stood out in the setting sun full 3000 feet above us. Immediately the sun set the temperature dropped from 60° to 34°.

We had now reached the top of the long slope that extends up to the base of the peak, which, according to Prof. Gregory, is the eroded central plug of the original crater. He asserts that the peak itself must have been between 3000 and 4000 feet higher than it is at present, and thus at one time the highest mountain in Africa. The main peak forms the centre of a ridge running almost due east and west. This ridge begins in the southern ridge of the Gorges valley, rises to Point Lenana at the height of 16,300 feet, and thence runs along to the foot of the main peak, dividing the Lewis and Gregory glaciers from one another. From there the ridge rises a sheer 1000 feet up to Nelion, which is lower than its twin peak Batian by 40 feet. From Batian the western arête descends to just above the Tyndall glacier, where it forms a bridge, and re-ascends to Point Piggott. From Point Piggott it again descends to

Arthur's Seat, and then to the eastern and western terminals, where



The summit of Mount Kenya: based on Mackinder's original survey, with additional information.

it projects into and divides the two heads of the Hausburg Valley. Another ridge or wall crosses at right angles to this main ridge, intersect-

ing it at Point Lenana. It commences in the north at the peaks of Tereri and Sendeyo, and forms the heads of the Hinde and Gorges valleys, gradually ascending to Point Lenana, its highest point. It then descends, forming the eastern border of the Lewis glacier and the head of the Hobley valley. It thereafter forms a semicircular ridge of hills, indicated as 5, 4, 3, and 2, and ending in 1, called Mount Hohnel, Phonolite Crag, or Castle Hill; this also is the upper end of the eastern ridge of the Teleki Valley. The glaciers flow either north or south of the main ridge, and go to form the rivers which proceed west or north, eventually joining to make the Gwaso Nyiro, which loses itself in the Lorian Swamp. It is rather strange that the sources of the Tana and other main rivers supplying the fertile south and eastern sides of the mountain are apparently not glacial in origin. I believe, however, that these rivers, which rise either in lakes or springs, eventually come from the glaciers themselves by subterranean passages. This is borne out by the fact that the Curling Pond, a small lake on the eastern side of the Lewis glacier, must drain into the Hobley valley, although there is no apparent outlet on that side. Its western border is a ridge of rock, while the eastern border next the Hobley valley is simply moraine, through which the water must filter.

On the morning of February 3 we found that the minimum temperature during the night had been 26°. Eight more of our boys were sent back from here to the Forest station, which they would reach that night. There remained with us, besides the cook, only two boys, Jocia, the headman, and Jim, a somewhat athletic teacher. These lads were chosen for their good football-playing qualities, which we trusted would stand them in good stead when we should come to climb the mountain. That day we made a preliminary climb to the ridge coming down from Point Piggott, and round the precipitous face of its eastern side above Tyndall glacier. We then examined the glacier and the prospects of an ascent by an all-rock route up this face of Point Piggott, across the intervening bridge, and thence up the western arête to Batian itself. This was the finest day of the trip; the peak was clear with the exception of a quarter of an hour in the afternoon. Tuesday the 4th was spent in rest, but in the evening we made a trip round the base of the east and west terminals, ending above a crag at the mouth of the Hausburg valley. There were two little lakes, the upper of which lies just 50 feet below the snout of the César glacier. The César and Joseph glaciers have a common origin on the face of the main peak and Point Piggott, and are joined with the Tyndall glacier by an ice bridge.

On the fourth expedition, of February 1920, we spent a whole day in this valley ascending an old moraine to the ridge that continues the northern arête; this arête comes from Batian and terminates in an aiguille, called Point Peter, corresponding to that on the other southern side known as Point John. The ridge then takes a right-angle turn and

CENTRAL PEAKS, MOUNT KENYA

LOOKING DOWN THE HOBLEY VALLEY

Phot. by Mr. J. D. Melhuish and by Dr. Arthur

THE TYNDALL GLACIER

BATIAN, NELION, AND THE TYNDALL GLACIER

forms the northern ridge of the Hausburg valley. Having reached this ridge, we got a magnificent view of the Mackinder valley, the glaciers of Krapf, Gregory, and Kolb, which flow into it, and beyond the north and south wall coming down from Point Lenana to end in Sendeyo and Tereri. We returned to Camp III. by passing over the ridge that lies between Arthur's seat and the eastern and western terminals, where some good rock work was experienced.

The temperature that night was 24°. On Wednesday, February 5, we made all our preparations for making a camp on the main peak. All the rock climbing is somewhat dangerous, as there is hardly a foot or hand-hold reliable. Rocks are constantly coming off the peaks, and rattling down to the glaciers below. The western tarn of Two Tarn Col debouches into the Hausburg valley, while from the easterly a stream goes by a sheer drop of 500 feet into the river that comes from the Tyndall glacier. This river, with those from the Darwin and Lewis glaciers, make the headwaters of the Naramoru river which descends the Teleki valley. From the fall we had a magnificent view of the main peak and its glaciers. The Tyndall glacier, the second largest of all, is in the valley between Point Piggott and the main peak, and comes from the bridge between them. Hanging from the slopes of Batian are the corrie glaciers of Heim and Foral, from which the ice constantly breaks off and falls to the Tyndall glacier below. From Nelion comes the southern arête, which ends in two aiguilles, the higher and uppermost of which is Point John. On the near side of this ridge is the large corrie glacier, the Darwin. It is connected by a couloir, with its upper portion lying on the face of Nelion. Between Batian and Nelion hangs the Diamond glacier, which has a large overhanging cornice and is connected below by a couloir with the Darwin glacier.

At two o'clock we set off along the steep face of Point Piggott. This was a difficult bit of rock climbing, but the boys got their loads safely along without a slip. We reached well up on the rocky side of Point Piggott, about halfway up the Tyndall glacier, at 4.30 and here pitched our Camp IV. Three of the porters returned to Camp III., while we retained the cook, Jocia, and Jim. The height was now 15,500 feet. There was of course no firewood here, but we had brought a Primus stove.

Next morning, Thursday the 9th, the peak was standing out above us in a clear sky, dark and magnificent, the moon shining on its glacier sides. By the time we were ready to start it was 7.30, too late for an ascent such as lay before us. We were roped up, I leading, then Jim and Jocia, and finally Melhuish. The boys were carrying I suppose, twenty lbs. each and we ten, but the going of the boys on this steep rock was very slow; it took us 1¾ hours to do what we had done in about half an hour in a preliminary climb the previous evening, and by 9.15 we hadn't even reached the main ridge. The mist was already hastening up from below and swirling round the peak high above us. It was obvious that for

that day at least the ascent was a forlorn hope. If we were ever to do it, our camp must be higher, to make the ascent sure in the morning hours. For stiff rock climbing the boys were not to be depended on, and we ourselves would have to travel with an absolute minimum of equipment, not really sufficient to spend a night out on the peak. As our time was now limited, we decided to abandon this route and make our second and final attempt by the route Mr. Mackinder had taken. We found on the Tyndall, as on all the southern glaciers, a snow condition which did not belong to the glaciers facing north. While the northern were quite normal, with the usual crevasses, those on the south were covered with little pinnacles of snow-ice, averaging about 1 foot or 1½ high. In the previous expeditions these penitentes were not noticed; they had formed now at the end of an abnormal year and a half, when rains had practically failed, and when during January the weather had been exceedingly hot, and for three months the sun had been in the south. On our last expedition in August 1920 we found small snow penitentes on the northern glaciers, but none on the southern. During the months previous the sun had been on the northern side of the mountain. In 1919, even on the Diamond glacier, this condition of the snow could be observed with glasses.

We got back to camp at twelve, by which time the mist was well down, and Melhuish went on to form a new base camp at the foot of the Lewis glacier. Next morning, Friday the 7th, we were off at 9.15, and reached the new base camp, Camp V., at 11.15. To the left above the camp was the end of the southern arête in the towering column of rock, Point John, and below it the smaller but similar aiguille. Over the crag towards the centre was the ice-fall and snout of the Lewis glacier, and to the right, extending towards Point Lenana, was the long gravelly lateral moraine. The branch of the Naramoru river, which comes from the Lewis glacier, rushed over the crag and passed the camp down the Teleki valley. In the early morning it was more than half frozen, with ice in the bed of the stream. There was plenty of giant groundsel and an assured supply of firewood.

That night the temperature again fell to 16°. We set off at ten, with a supply of firewood for a higher camp, but the peak at this time was already shrouded in mist. The going for the boys with loads was heavy on the gravelly moraine, but slowly we ascended. At 12.30 we reached the frozen lake which we called the Curling Pond; the ice bore, and though the surface cracked and the upper layer was very soft, it was real ice 2½ inches thick. We had now reached 15,900 feet, and formed Camp VI. We had intended getting on the southern arête that evening, to give us time to look round about the peak the following morning before the mist came down, but a hailstorm made us decide to remain where we were for the night. At four it began to clear, and at 4.55 Melhuish and I set off to climb Point Lenana, some 400 feet above us, which we reached at 5.38, just when everything was at its best. To the

west of us was the main peak silhouetted against the setting sun. Between us and the peak was the ridge separating the Lewis glacier with its snow penitentes on the south side from the Gregory glacier on the north. North were the large valleys, the Mackinder, Hinde, and Gorges; east was the Hobley and other valleys descending east and south, and then came the Teleki valley going south-west. Through the drifting mist on the plains below could be seen many of the landmarks of the country, including the hills Kiang'ombe, Donyo Sabuk, Kinangop, and Sattima. From here, in February 1920, our party saw the peak of Kilimanjaro, over 200 miles away.

The Curling Pond next morning was covered with a glorious sheet of ice, about 100 yards in diameter, but unfortunately we had no skates. The ice did not begin to soften till well after eight, so that one could easily have skated for a couple of hours. In February 1920, when I took skates with me, the curling pond had almost entirely disappeared, with the exception of a small strip about 15 yards across, with a centre of bad ice. I skated there for a little while in order to say that I had done so on the equator.

At 9.20 we set off up the side of the Lewis glacier for a bit, and then started to cross the Lewis glacier, with the five boys carrying their loads in single file; as we had no boots for them they bravely agreed to do the passage on their bare feet. In the morning they did not seem to mind very much, but complained more on our return in the afternoon after a fresh fall of snow. We crossed a couple of lateral crevasses, and hen made our way right over the main glacier, just below a narrow crevasse stretching almost the whole way across. One or two good bergschund crevasses were seen just below the junction of the glacier with Point Thomson and the main ridge. We reached the foot of the southern arête at ten o'clock, having taken about half an hour to cross the glacier, about half a mile wide.

Up till this time it had been lovely, but the mist was rapidly coming down. We had no difficulty in getting on to the edge of the southern arête by way of a small moraine which slopes gently down its face, but the mist had already covered the peak. Leaving the boys there, Melhuish and I started off up the knife-edge of the arête, which proved by no means insurmountable. Its inner lip was overhanging towards the Darwin glacier, but access was found on the Lewis glacier side, and we were able to do a delightful bit of rock climbing, but were eventually brought up by an impasse in the shape of a gendarme—a gap in the ridge with a perpendicular column of rock beyond: probably the identical gendarme which had stuck Mr. Mackinder and his party in their first attempt to climb the peak. There was nothing for it but to descend to where we had left the boys, and as another hailstorm began to come on we rapidly pitched our tents where we were. It was evident that the weather had now broken, as the mist was coming down early in the mornings, and

there were these thunderstorms in the afternoons; we reluctantly came to the conclusion that we must give up the attempt. It proved a wise decision, as during the ten days thereafter the mountain was never clear and there were constant thunderstorms. The rains had broken a month before they were due.

Mr. Mackinder's route on his last attempt had been up a small couloir which descended from below Nelion on to the Lewis glacier. He had gone up part of this couloir, thereafter making a traverse or two on the rock, and finally reaching the arête above where they had been blocked in their previous attempt. There they had spent a night out roped to the rocks, and a somewhat cold experience it must have been. Next morning early, they crossed the upper portion of the Darwin glacier and the rib which comes down from Nelion and on to the Diamond glacier. It took them three hours to cross this glacier, where the ice was found to be extraordinarily hard, hence its name, and reach the Gate of the Mist between the twin peaks. From there it was a short scramble up on to Batian, which they ascended at one o'clock triumphant. It may thus be seen that the final camp must be made on the top of the arête in order to give time for the last 300 feet, and even then weather conditions must permit of it.

In our expeditions of February and August 1920 we also went up the couloir about halfway, but on both occasions we were foiled—on the first because of the difficulties of the rock climbing, and on the second because we could not get off the couloir on to the rock, as the crevasses were all filled with solid ice. In the February expedition we had slept out at the foot of the main peak on a ledge of rock without a tent, and it was the most uncomfortable night that I ever spent. The weather in February and August was far from good, and turns of mountain sickness did not add to our chances.

We have proved pretty well in our experience that mountain sickness and headache are due as a general rule to over-exertion by trying to do too much. Climbing at this altitude has always to be exceedingly slow. We found, however, that with slow going the pulse rate was not much increased. Melhuish, who is normally about 70, had sometimes a pulse rate of 80, but my own, which normally is about 50, was very seldom quicker. There was another condition, however, which was extremely interesting and which I first began to notice in the expedition with Melhuish. I suddenly found, while resting on the southern arête, that I was breathing in the peculiar manner known as "Cheyne Stokes," a condition that one finds normally only when a man is at his last gasp. I then discovered that Melhuish also had the same condition, and in the succeeding expeditions all the members were affected similarly in these higher heights. It did not prevent one from doing a considerable amount of work. During the five expeditions no single porter has been lost, but a number of them were quite seriously ill with acute pneumonia, probably

CENTRAL PEAKS FROM THE TELEKI VALLEY

POINT THOMSON AND THE LEWIS GLACIER

CREVASSE IN THE LEWIS GLACIER

TWO-TARN COL AND POINT JOHN

phthisical; this led to my having a trained hospital assistant always in my parties.

During the last three expeditions numerous bearings were taken by prismatic compass, on the west, east, and south sides. On the last expedition the sources of seven rivers, the Nairobi, coming out of Lake Höhnel, the Nyamindi, Ena, Rupingazi, Thuchi and Ruguti, were discovered in springs or lakes below the precipitous faces of the ridge which forms the north and south wall. In the expedition of 1916 we found that it was the Nithi river which flowed down the Gorges valley, rising from springs at its head. A map was prepared for our expedition of February 1920 by Major Kempthorne, Director of Topographical Surveys, which was accurate for all hills and rivers up to about 10,000 feet but not beyond. Major Kempthorne, assisted by Mr. Norman, has prepared a map based on Mr. Mackinder's original survey, but embodying the observations of this expedition; and this has been made the central portion of the War Office map of Mount Kenya, which is on the point of publication. The observations of August 1920, which have given considerably more information as to the hills, rivers, and valleys on the eastern side, were not available for this map, but these have been embodied by the Map Curator of the Royal Geographical Society in the map published herewith. The heights on the 1920 route are from readings of a mercurial barometer.

Before the paper the PRESIDENT said: I have the pleasure to introduce to you Dr. Arthur, of the Scottish Mission in the colony of Kenya. He has spent many years in Kenya, and will describe to us this evening several attempts he has made to ascend Mount Kenya, and will also give us an account of that interesting colony.

Dr. Arthur then read the paper printed above, and a discussion followed.

The PRESIDENT: We shall be grateful to Sir Halford Mackinder, who is probably the only human being who has ever reached the summit of this mountain, if he will kindly give some account of his experiences.

Sir HALFORD MACKINDER: I should like in the first place to thank Dr. Arthur for the great pleasure he has given to me—probably more pleasure than to any one else in this room. I hardly know which it was that interested me most—the description of the mountain, when he called up memories of twenty-one years ago with every sentence, or the pictures of the present condition of the region through which you approach the mountain. I camped on the site of Nairobi before it existed, and you have seen the fine buildings there now. I think that gives some measure of the speed with which things have moved forward in Kenya Colony. Perhaps our greatest difficulty twenty-one years ago was in getting to the mountain at all. It was a time of famine; it was a time of small-pox; and the Uganda railway had only just reached the Athi plains. I was waiting for it to do so, because everybody who had been to the mountain before had been defeated by the fact that he had got fever into his bones, and I determined to rush the expedition, as far as possible, through the fever zone to the heights. By dint of great care we did it, but then we had to race away from small-pox, though even that we managed to keep clear of until

nearly the end. When we were 10 miles away from the railway we were already in unsurveyed and almost unknown country. Those Thika falls which have been shown to you were out in the wilds, and to-day there is a hotel beside them. Through the forest itself, of course, we had the same scenes that have been depicted on the screen just now.

May I congratulate Dr. Arthur on his perseverance in gathering scientific knowledge round this mountain? It is the way in which the science of geography must now grow—by people who settle beside some great physical feature and explore it thoroughly year after year, learning its climatic conditions, and so giving us finished geography, which we pioneers can only be thankful for and admire.

It is difficult to know exactly to what point to direct your attention, but it has occurred to me that if there are any Alpine clubmen present, as I dare say there are, their attention may have been caught by the observation made by Dr. Arthur just now, that it took my expedition three hours to get across that little glacier at the top. We called it the Diamond Glacier on account of its hardness. I may tell Dr. Arthur that during the past autumn his father called upon me and gave me a typewritten account of his son's last expedition—the expedition of August—and I found with great interest in that account that when Dr. Arthur was going away from the mountain, he saw through his glasses that the Diamond Glacier, instead of resembling the other glaciers in being covered with snow, was of green ice. We thought we could get across the Diamond Glacier when we first came near it in about twenty minutes. We found it intensely hard and very steep, and as it ended below in an overhanging cornice, we knew that an accident would probably be a fatal one. Therefore we had to cut pretty careful steps, because we knew we should probably have to come back through the afternoon storm. Every afternoon there was a wind and hail-storm on the peak, and it was well we took such care, because when we did come back it was through a driving cloud, and we had to clear the hail out of the steps. The ice was intensely hard, and up at 17,000 feet, even when in the fittest condition, it is not easy to work hard. But in addition to the mere height, we had no sheep to feed upon as had Dr. Arthur, and were living upon tinned provisions. I think Dr. Arthur said that in his experience the chief reason of mountain sickness was hard work. The particular kind of hard work which incapacitated me was digestion. I reached the summit because I took no solid food for thirty-six hours beforehand. I lived on meat lozenges, and by taking one every half-hour and going slowly, I got there.

I think, perhaps, I ought to mention that it was not one o'clock but twelve when César, Joseph, and I got to the top. I think it is important to correct that point, because I imagine that in Kenya Colony you will presently have an Alpine Club formed. They have one in South Africa, and the temptation is smaller there than in East Africa, where you have the magnificent peaks of Kilimanjaro, Kenya, and Ruwenzori. I should recommend the clubsmen to put a hut on to the south arête of Kenya. We spent the night up there. We could not carry heavy equipment up, and had to rope ourselves to the rock and grin and bear it. You must sleep at that height, because by twelve o'clock at the latest the cloud swirls round you. I gather from the accounts given by Dr. Arthur, and he made these ascents at two different periods of the year, that the régime of the weather was exactly the same as in the month I was there. You have the afternoon storm, and at sunset the sky clears. At ten o'clock at night, with the moon shining, the sight of the great peak above you is magnificent. The stars look like lamps in the black sky. All through the night it remains

calm. In those valley heads it becomes very cold, and you get bottom ice formed in the streams. In the morning it remains beautiful, but somewhere between nine and twelve or one o'clock every day there comes up a hailstorm accompanied sometimes by thunder. You ought to be back on the arête, having been to the top, before that comes on. We were not back in time, but I should not advise anybody to tempt Providence again, and the peak can easily be achieved with a proper Alpine equipment provided you spend the night on the arête in comfort and you have luck in finding the glacier in a practicable condition.

Just one word as to names. Batian and Nelion were Masai chiefs. When I was out there the great plains, which are now covered with farms, were of course vacant. When I camped where is now Nairobi, out of the dead-level plain within a mile or so would browse a herd of three or four thousand mixed game. The Masai then wandered over those plains, and were still to a large extent masters of the region that had been theirs—nomads driving cattle—but it was already evident that they were doomed, because the white man was coming, and would want those great prairies for his farms. He would want labour, but it would be the labour of cultivators such as the Kikuyu. The Masai, although cruel, were a fine race. They thought of their god as dwelling on the peaks of Kenya, and I felt it was right that a memorial of the noble savage should there go down to history. The hero chiefs of the Masai two or three generations before the white man came were Batian and Nelion, two brothers it was said. Lenana was the living chief of the Masai at the time I was in East Africa. We took with us two Masai, and they carried Lenana's knobkerry by way of a passport in case we met any Masai out on the warpath. Tereri and Sendeyo were names of other Masai chiefs. Point Thomson was named after Mr. John Thomson, the photographer to this Society. My colleague, Mr. Campbell Hausburg, was, I believe, the first explorer to bring back to this country pictures in colour photography, and Mr. John Thomson took great trouble in arranging the apparatus, making all the preparations for that experiment, and that point was named after him by way of a thank-offering.

I will only refer to one other matter. We took no natives higher than 10,000 or 11,000 feet to sleep. Our top camp was at 13,800 feet. The natives used to come up in the middle of the day and bring our stores up, and go down to sleep at 10,700. I found that they soon broke down in the higher altitudes. They got pneumonia, and that apparently was the experience in the various expeditions of Dr. Arthur. As a consequence we found it was necessary to travel absolutely light. Our anxiety was to secure the condition and equipment of an Alpine party for that last thousand feet, and yet to face the rough and tumble of a month's travelling through untamed tropical conditions. The way it was done was by taking out forty boxes packed in this country, hermetically sealed, each weighing twenty-five pounds. Of course we had no horses. It was all walking and human porterage. Each tin box contained all that a white man would want for six days, even down to matches and toilet requisites. Those forty boxes saved us. We travelled through a country in a state of famine with the natives at war with one another. They ambushed some of my men and killed two of them. The forest was inhabited by a people that Dr. Arthur has not spoken of—not quite dwarfs but nearly so. The Masai are nomads, the Kikuyu till the ground, but the Nderobbo are hunters in the depths of the forest. We never saw them; we never could establish relations with them, and yet they were always watching us. We slept in the starlight and moonlight,

watched. When we left a camp in the Kenya forest, if we had occasion to go back ten minutes after, the empty tins were all gone. Towards the end, when I had sent away a considerable number of our porters because I could not feed them, we were unable to move our supplies without making double journeys. Having made the first journey we went back to fetch the remainder of our stores; everything had been looted with the exception of the tin boxes, and they remained. I suppose the Nderobbo came to the conclusion that they could not open them, or perhaps did not even realize that they were boxes. Those boxes saved us to the end. The whole secret of our success was that we travelled light on the heights, having concentrated foods. We went round the mountain twice at high levels. That cairn which you saw on the top of Lenana was put up by Mr. Hausburg and César and Joseph. I had to go down to the foot of the mountain, and they spent the time on a photographing round. I went the second round with the two guides, and we spent three days at heights of about 15,000 feet, making a plane-table survey of the mountain. We had to carry our plane-table and also our firearms, because we did not know what we should meet. We could not carry much weight in the way of food, and we could not carry a tent, but we could light fires of groundsel, and so we lived out in the open. I found no difficulty in breathing at the very top, but I am inclined to think that the conditions under the equator are perhaps not quite the same as elsewhere. I thought at the time that the hardness of the Diamond Glacier was due to the fact that it was mainly formed of hail. Whymper, in his account of the equatorial Andes, speaks also of the intense hardness of the glaciers when you get to the great heights. I ought finally to say that we could easily have climbed the second peak, Nelion, but the storm was coming on, and we did not think it worth while to risk our lives further.

Sir FOWELL BUXTON: I have no qualifications, either as a geographer or as a mountaineer, to be on the platform now, but I was Dr. Arthur's companion on the last occasion he attempted to climb the mountain. What I should like to say is in connection with the porters who carried our tents and supplies up —that it is largely due to Dr. Arthur's work amongst those people that they were willing to go with us at all. They are not mountain people. Few, if any, of them had lived at a higher altitude than the lower edge of the forest, but the very valuable medical and educational work that Dr. Arthur and his colleagues have done amongst these people has won for him their confidence and affection, and I think the fact that on so many occasions he has been able to organize these expeditions is very largely due to the personal tie between him and them. I believe that an audience like this will join with me in hoping that after so many attempts, he may one day succeed in reaching the top of the mountain.

The PRESIDENT: It is a wonderful thing that everywhere a European goes, if he sees a mountain, and especially if it is a pretty stiff one, he immediately tries to get to the top of it. This mountain has been standing in the middle of Central Africa for perhaps millions of years, and yet the inhabitants of those regions have in all probability never attempted to ascend it. It was not until some white men went there that men not only attempted but succeeded in reaching the summit. We congratulate Sir Halford Mackinder in having achieved that great feat—for it must be a great feat, as we realize when we see the tremendous difficulty of the rock climbing. We must also join with Sir Halford Mackinder in congratulating Dr. Arthur on having done such valuable work in filling in the geography of that region, making us better and better acquainted with the mountain, its slopes, glaciers, and rivers. One of the great difficulties must have been in the way of getting porters to accompany the

expedition. A single mountain rising up in the middle of a plain, carries on it no mountain peoples like there are in the Himalaya, Andes, and Alps; only a plains people are available, with bare feet, to go into what, to them, must have been terrible regions. It was doubtless due to the personal ascendency which Dr. Arthur had established over these people, and the affection he had instilled into them, that he was able to get them to follow him into those high regions. I am sure you will wish me to thank Dr. Arthur for having given us this interesting account and the valuable information about that region, and for his excellent slides, and will join with Sir Fowell Buxton in hoping that eventually he may be able to accomplish his ambition and get to the top.

PRESENT-DAY CONDITIONS IN SPITSBERGEN

J. M. Wordie

Read at the Meeting of the Society, 21 *March* 1921.

IN the opinion of the writer the thorough scientific exploration of an unfamiliar region—especially within the polar circles where the navigating seasons are so short—entails continual work throughout at least three seasons. Of these the first can then be devoted to reconnoitring the broad features of the country; in the second the main spade-work of detailed investigation can be carried out; the third can be usefully occupied in the filling up of gaps and in revision of the more difficult problems. The explorations on which the present paper is based were made during a seven weeks' trip to Spitsbergen in the summer of 1919, and one of four months' duration in the summer season of 1920. A third visit would be desirable to round off the work, but, in the mean time, it is possible to speak with some assurance of the present-day conditions and of the geological history of that interesting island.

I propose to describe in some detail the two areas in Spitsbergen which I know best, Prince Charles Foreland and the lands round Stor fiord. The economic exploitation which has been the feature of the local history of the last few years has altered certain other parts almost beyond recognition. A description of Spitsbergen to-day would therefore be incomplete without some account of these developments in mining activity.

Prince Charles Foreland.

The Scottish Syndicate at whose instance the work was undertaken had intended that I should devote last summer (1920) as far as possible to Stor fiord; but as that inlet is not navigable with safety before August, arrangements were made to spend the first few weeks of the season on Prince Charles Foreland. This was in some respects unfortunate, as the season at the latter place is much later than farther east in Ice fiord, and exploration was much handicapped in consequence.

The persistence of the glacier covering of Spitsbergen and of the

annual increment of winter snow are both—though possibly in different degree—controlled by the balance between the two main factors, precipitation and denudation. Thus the heavier snowfall in western Spitsbergen is responsible for a comparatively late season on this side of the island considered as a whole. On the other hand, the protection from denuding forces afforded by the bulk of the coastal ranges to the accumulations of snow and ice upon their eastern flanks causes the best development of glaciers to be found on that side. The same rule holds good for the winter snow, which is the main obstacle to inland exploration in the early summer. For instance, we saw the snow of the winter of 1919–1920 disappearing fifteen days earlier from the west than from the east side of the Foreland, and from the coast of the mainland earlier than from the interior, in spite of the relatively heavier precipitation.

On the average the west side of the Foreland, together with the coast of the mainland, seems to be clear of snow about June 25–30, the east side not much before July 15. As late as July 19, when all the snow had disappeared, the surface of a good portion of Richard lagoon was still covered with fast-ice. On that date a companion and myself crossed this ice for 2 miles whilst making a short cut. A hard frost made the ice just passable on a roundabout course, avoiding obvious weak places. At less favourable periods, even earlier than this date, a thin layer of fresh water completely masked these weak parts and made travel upon the ice quite impossible.[1]

The original plan was to make the base camp on the west coast. There are no good anchorages, however, on this side of the island, and a spell of stormy weather occurring at the very time when the expedition arrived effectively prevented landing at the desired spot. As time was limited the sloop steamed round Vogel Hoek to the east coast, and dropped anchor off the mouth of Richard lagoon on June 26. It was a further misfortune that the tidal current was running out of the lagoon at the time, so that the small boats in which we were landing could make no headway against it. Landing was made much more arduous by this fact; for it was necessary to go ashore on the gravelly spit bordering the lagoon mouth, and "track" the boats against the current. Once the entrance was achieved, the boats were rowed across to the edge of the fast-ice, and from here all the stores were conveyed by sledges to terra firma, a distance of about half a mile. A small motor launch, or means of converting one of the boats into a motor boat, would have made landing easy and rapid at any state of the tide.

The base camp established in this way on the west side of the lagoon consisted of two bell tents, one of which was always reserved for stores. During a spell of bad weather later on, the other bell tent, roomy as it was, proved to be none too large for our party of six. At the first opportunity an outside galley was built of turf somewhat in the style of a grouse butt. For fuel I had relied upon the driftwood which I had

been informed was to be found in plenty all along the coasts. On arrival, however, everything was deep in snow: search as we might, not a single log fit to burn was to be found. A few weeks later there was enough driftwood at this same spot to supply the needs of a small army. As it was, I was obliged to modify my plans, push across the mountains earlier than had originally been intended, and establish an advanced camp on the west coast, where the season, as we had very soon learned, was more forward.

In this and future journeys the method of transport was by "packing." The two Mummery tents (without the usual sewn-in ground-sheet), reindeer sleeping-bags, food, and miscellaneous stores were divided according to individual capacity among the men composing the party. Reindeer bags are often objected to on account of their weight (10 lbs.), but I am convinced, as the result of my experience on this and other more extended journeys, that they are far to be preferred to the lighter woollen bags or the still lighter eider-down coverings. They recover more quickly and more thoroughly from the frequent soakings any sleeping-gear must receive where there is much snow about; and they offer a degree of insulation from the cold ground beneath, which neither the woollen nor the eider-down bag can approach. As regards the rest of the load carried, this was reduced to a minimum by confining the basic ration to foods of the flour and sugar type. This ensured a sufficient supply of carbohydrates, and a properly balanced ration was completed by the numerous eider duck and geese, and occasional ptarmigan, shot by the party.

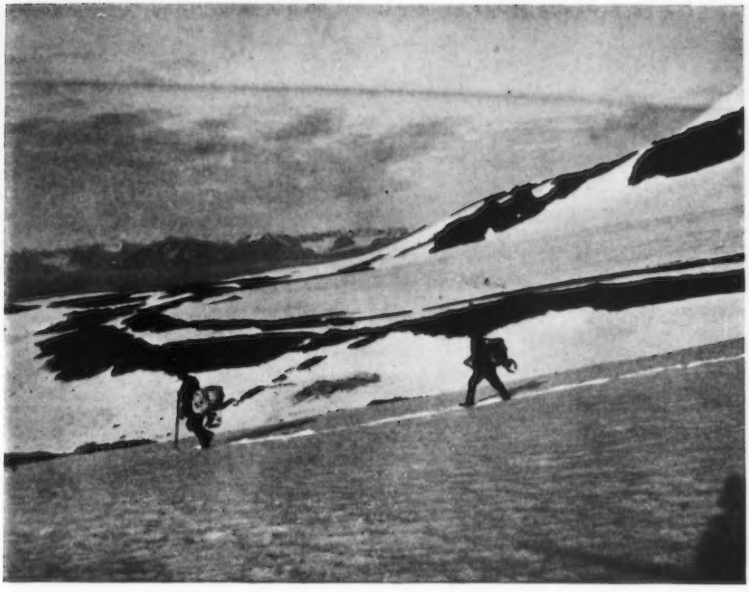
It had been my good fortune previously to enjoy the help and advice of Dr. W. S. Bruce, not only in Scotland but also when a member of his party in Spitsbergen in 1919. On the Foreland his experience had been wide indeed, gained during three full summers spent there in 1906, 1907, and 1909, during which time he made investigations in every department of science. Geographically, the most important outcome of these three visits was the charting of the island on a scale of 1/140,000, the first really minute piece of mapping done in Spitsbergen. This map made a good basis for our own surveys of the coast. Dr. Bruce's parties appear, however, to have been denied both the time and the weather to deal as accurately with the mountainous interior, and it is therefore fortunate that Major Isachsen of the Norwegian Army was able to revise and complete the map. In the course of surveying the western part of the mainland between Red bay and Bell sound, the latter found it necessary to include some of the Foreland peaks in his network. He took advantage of this to arrange for a strong party to spend a summer on the island in charge of Captain Laurantzon. This party climbed several of the lower mountains, and employing rapid photogrammetric methods was able to correct and complete Dr. Bruce's map. Major Isachsen's map was therefore the more useful of the two, both because it was complete, and also because it was among the mountains particularly that our sphere of work lay.

Errors on the Norwegian map were very rare indeed; the rapid and yet accurate way in which the party must have worked reflects the highest credit both on their organization and their efficiency.

As our time on the island was limited it was necessary to cover the ground as rapidly as possible, and this fortunately did not prove difficult, for once the snow was melted the going proved excellent. When carrying a pack, or when crossing deep soft snow, our pace was somewhat under 1½ miles per hour; at any other time little difficulty was experienced in travelling 2½ or even 3 miles in the hour, always provided one's boots were comfortable. In the early part of the season we had the same trying experience with snow-bogs as has been recorded by Sir Martin Conway, some of whose descriptions might have been written of Prince Charles Foreland. This was especially the case when we were making strenuous yet fruitless attempts to find driftwood on the east coast; but as the season advanced and the snow melted, all difficulties of this sort speedily vanished.

A marked feature of the physiography of the Foreland is the raised beach, varying from a few yards to over a statute mile in breadth, which encircles the island except where interrupted on the east coast by the Monaco–Buchanan piedmont and the Geikie glaciers. Exploration is much facilitated by the presence of this broad horizontal platform. The raised beach and the numerous low passes through the mountains towards the northern and the southern ends of the island always provide a dry though a rough road. Even where the raised beach is interrupted by the two ice formations mentioned above there is little to hinder the progress of a party, though unarmed with either ice-axes or Alpine rope. In the short period during which the winter snow is being dissipated, slush here as everywhere else is an obstacle, but even so two of us crossed the extremely slushy Buchanan piedmont in the middle of July, covering a distance of rather under 5 miles in two and a half hours.

Travel in the interior of the island may or may not be much more difficult. The most northern part between Vogel Hoek and Mount Helland is practically without glaciers, any ice found being in the form of derelict ice-slabs and patches of snowdrift ice. The hills are of moderate relief, precipitous peaks like Mount Conway being exceptional, and the contour of the country bearing a considerable resemblance to the Grampian mountains in Scotland. Numerous passes—as, for example, Glen Nigg, Glen Mackenzie, and Glenbeg—offer easy avenues for detailed exploration. South of Mount Helland glaciers appear, and occur intermittently to the south as far as Mount Methuen. The conditions of travel, however, are not made appreciably more difficult by their presence, though rope and ice-axe are certainly advisable. North of Mount Monaco and south of Mount Jessie the glaciers add considerably to the interest of the mountain journeys, but that is all that need be said of them. To a traveller with any knowledge of Alpine



"PACKING" ON PRINCE CHARLES FORELAND

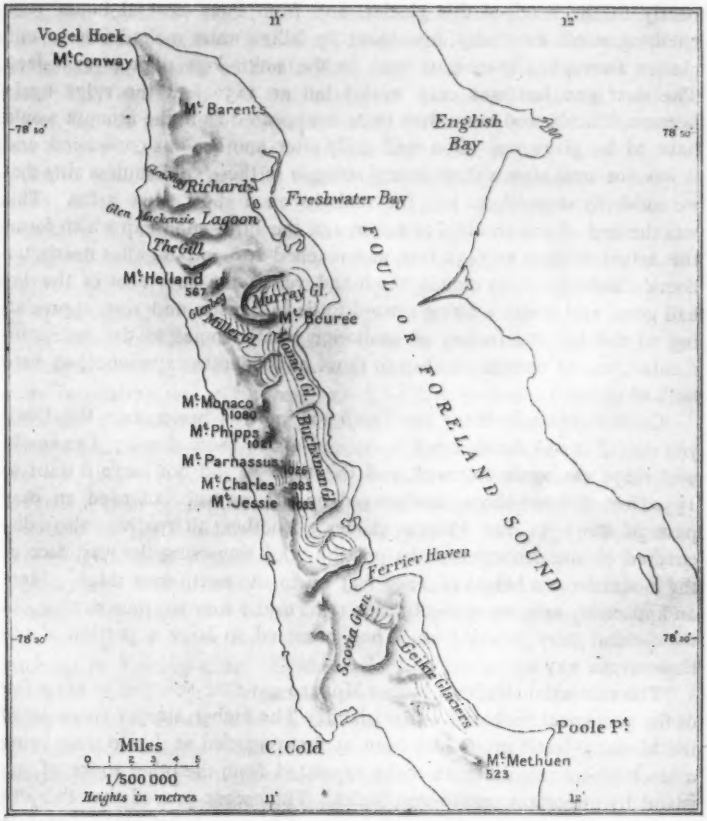
MOUNT JESSIE, PRINCE CHARLES FORELAND

ICE-FREE REGION, MOUNT MIDDENDORF, EDGE ISLAND
Phot. by G. W. Tyrrell

MONACO RANGE AND MILLER GLACIER, PRINCE CHARLES FORELAND

countries they are not a matter of serious consideration affecting his daily itinerary.

In the mountain tract between Mount Monaco and Mount Jessie the case is very different. This group was many years ago indicated as a likely mountaineering field, and such it certainly is. The highest peaks of the island are found here—Mounts Monaco, Phipps, Parnassus, Charles,



Sketch-map of Prince Charles Foreland.

and Jessie—and the ascent of these should make first-class mountaineering expeditions. In all other parts of the island my party had been accustomed to treat mountains and hills as minor obstacles; but they soon found that this was by no means going to be the case with the Monaco group, one at least of which had to be climbed if we were to gain a correct idea of the structure of this interesting range.

After some consideration it was decided to attempt the ascent of Mount Monaco itself, the highest and shapeliest of all the Foreland peaks, and on July 17 the ascent was commenced *viâ* the south-west ridge, which seemed from below to afford the earliest route. For about 1300 feet Mr. Donald Campbell, my assistant, and I followed this ridge up over moderately interesting rocks, but at that height precipitous cliffs forced a retreat southwards down to the Phipps glacier. We then ascended nearly to the head of this glacier, and from there several hours' rock climbing, made extremely unpleasant by falling water melted from a cliff glacier above, finally took us back to the south-west ridge at 1750 feet. The next 500 feet was easy work; but at 2250 feet the ridge again became difficult, and more than once it appeared as if the attempt would have to be given up. One iced gully after another was conquered, and it was not until after a three hours' struggle in these cold sunless rifts that we suddenly stepped out into the sunlight on a short snow arête. This was the end of our trouble, however, and the little snow-cap which forms the actual summit at 3450 feet was reached at 8.30 p.m. after nearly ten hours' climbing. The clouds which had veiled the sun most of the day had gone, and it was a fitting reward to lie in the sun and rest, appreciating to the full the feeling of exaltation which comes to the successful climber, and to none more than to those of moderate experience, as were both of us.

On the principle that "the Devil you know is better than the Devil you don't," it was decided not to attempt a new route down. The south-west ridge was again followed, and this time we did not leave it until at 1550 feet a stone-shoot, unobserved on the way up, afforded an easy passage down to the Phipps glacier. Another alternative also discovered on the descent was the possibility of traversing the west face of the mountain at a height of 2250 feet on to the north-west ridge. Here an apparently easy snow climb leads right to the summit, thus cutting out the difficult gully climbing which had occupied so large a portion of our time on the way up.

The successful climb on Mount Monaco gave the solution to not a few of the geological problems of the island. The higher, steeper character of the Monaco–Jessie group had been at first regarded as due to their being a block of entirely different rocks separated from the other rocks of the island by important east-to-west faults. The ascent proved that this was not the case. The rocks certainly are different; but just as certainly there is no structural break between them and the rest of the Foreland. It seems clear that in early Palæozoic times massive igneous intrusions in the shape of thick lenticular sills or laccolites were localized in the Monaco–Jessie region. This igneous activity was followed by a period of folding, during which the Hecla Hoek rocks were thrown into recumbent folds. The "epidiorites" of the intrusions being of more massive structure withstood the pressure and acted possibly as kernels. To-day

their greater resistance to the denuding forces has caused them to stand out from the weathered remains of the enveloping strata as the cliffs which give to Mount Monaco and Mount Jessie their dominating character.

That there may be shatter-belts across the island, which help to carve it into separate hill groups, is admitted; for their presence would offer a ready explanation of the very numerous low-level passes from east to west. Except at the north end of the island, however, there do not appear to be any actual east-to-west faults. The structure consists of a series of north-north-west to south-south-east folds, by which quartzites, shales, and limestones of Hecla Hoek age have been overfolded to the west. The elucidation of the history of the island was not an easy matter, for the southern slopes in many cases are covered with screes from top to bottom. On the steeper northern slopes, however, the structure could sometimes be made out. In this connection it may be noted as an interesting feature of Foreland physiography that the mountains so prominent in its formation neither bear any relation to geological structure (except in the case cited above) nor show any of the features usually considered as typical of glacial erosion, if we except a general appearance of over-deepening of most of the valleys.

If, as indicated above, the island owes its shape and direction to the Palæozoic folding, it owes its present detached position to a later still more interesting set of movements. The first evidence bearing on this point was the discovery by Dr. Bruce in 1906 of Tertiary plant fossils—perhaps the most important contribution so far made to Foreland geology. We were able to follow up this discovery last summer, and ultimately to reach a clear conception of the structural relationship of Prince Charles Foreland to the mainland. The Tertiary beds have at their base an exceedingly coarse conglomerate, no doubt marking the shore-line of the Tertiary sea transgressing on to the Hecla Hoek mountains.* This unconformity would always be found marking the junction of these two rock series, had it not been for a complicated set of earth-movements later on in Tertiary time. Evidence of two distinct sets of movements has been found: (1) Tangential pressure resulting in the thrust of a block of Hecla Hoek rocks on the mainland eastwards right over much younger rocks ranging from Carboniferous to Jurassic in age; (2) Radial movements leading to a downward collapse of the Earth's crust. Traces of the tangential pressure are visible in the younger beds as far east as Klaas Billen Bay.

The relation of the second type of movement to the first has not yet been explained, but its principal visible effect was the formation of Foreland sound. The Tertiary exposures found along most of the eastern side of the Foreland are portions of the down-faulted area. This has not collapsed along a single master fault, as might be expected, but

* These beds may possibly be partly of Cretaceous age, since plant fossils are not the surest index.

along at least two or perhaps three parallel faults. Traces certainly of two and possibly of three such faults were found north of Ferrier Haven; the most westerly of these separated downthrown Tertiary beds from Tertiary conglomerate resting unconformably on Hecla Hoek slates. Foreland sound is therefore a trough or "graben," and Prince Charles Foreland a "horst."

A question which arises as a sequel to detailed exploration of an unoccupied self-contained tract of land such as Prince Charles Foreland is that of the turning of such a region to the most profitable account. There are, of course, mining possibilities, and already three mining companies claim the island. As a mountaineering playground or as a hunting preserve the small size of the island detracts much from its value. Bear and reindeer have altogether disappeared, and the eider-duck and geese which frequent its pools and marshes can just as easily be obtained elsewhere. Apart from mining, there remains one other possibility: the establishment of a farm for the breeding of fur bearing animals such as the Arctic fox. At one time foxes were very numerous; Dr. Bruce, for instance, has described how they used to come within a few yards of him, and how they were a perpetual nuisance round all his camps. Things are somewhat different now; though fox tracks were seen occasionally last summer, the animals themselves are now very shy. The present falling off in numbers was brought about by a wintering party of two Norwegians a few years ago, who, as in many similar cases, pursued a selfish and short-sighted policy, which if persisted in might have led to extermination. The island, however, is most suitable for the species, and in due time the head of foxes should increase again to numbers sufficient to guarantee a reasonable return for the small outlay that would be necessary to assist Nature to restock one of her own preserves. Dr. Bruce was the first to bring forward the idea that the island would make a good fox farm; to us last summer it seemed a perfectly sound and feasible plan.

Stor Fiord.

As soon as the season was well advanced we left the Foreland on July 22 in order to commence the detailed geological and cartographical exploration of Stor fiord. We were naturally averse to leave now that the snow had melted and good weather set in, and this feeling was strengthened by the various delays consequent upon important discoveries of coal at the head of Klaas Billen bay. It was not till August 8 that a small party with Mr. John Mathieson as leader was able to leave Billen bay in the motor sloop *Autumn* (Captain Kristian Johanneson). The passage round to Agardh bay took about forty-eight hours, but a thick fog—not unusual at this period of the year—completely shrouded the coastline, and it was another twenty-four hours before the captain could get his bearings and come to anchor off Cape Dufferin.

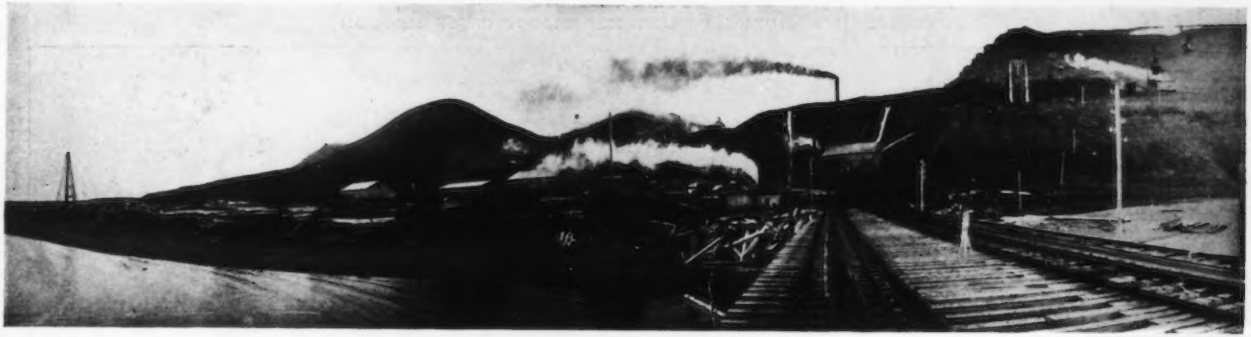
NORDENSKJÖLD GLACIER, BILLEN BAY, FROM MOUNT ROBERT

NORDENSKJÖLD GLACIER, BILLEN BAY

Phot. by J. Mathieson

ADOLF BAY AND PYRAMID MOUNTAIN FROM POINT NAPIER

Phot. by J. Mathieson



LONGYEAR CITY, ADVENT BAY

Phot. by W. S. Bruce

As a rule Stor fiord is difficult to enter, sometimes even in August, on account of pack-ice, and we were quite prepared for a delay of some days. In this respect, however, 1920 proved to be an exceptionally good year, comparing very favourably with my experience in 1919 in the same region. The conditions in the latter year are worth putting on record. As soon as she had rounded South Cape the *Phantom* (Captain Tjosass) found herself in loose drift-ice, composed of floes small in area but heavy and hummocked, through which the ship pushed her way with difficulty to a point near the foot of Mount Keilhau. A couple of us then went ashore and climbed the mountain (1946 feet) to study the disposition of the pack to the north. From here we could see over the fringe of drift-ice, and to a welcome feature beyond, a wide bight which ran into the pack for about 10 miles. We returned with all speed to the ship, and after some persuasion the captain agreed to weigh anchor and to make trial of the reported strait, in spite of his own judgment founded on the close appearance of the ice in the immediate vicinity. The ship was got under weigh, and we zigzagged through the heavy masses of drift-ice and sailed up to the head of the bight. Here we were again temporarily held up by a "sea-bar," the term whalers give to the local segregation of otherwise open pack along its outer edge by a swell. As usual in a case of this kind it took some hours to find an opening, both manœuvres and vision being hampered by a thick fog. Once through the bar, however, the Stor fiord ice offered no further difficulty, as it was open pack, then drift-ice, and finally in the inner parts merely scattered floes. Light south-westerly weather prevailed at the time, and this is noteworthy in view of the fact that a few days later a strong gale from the north-east drove every particle of ice out of the fiord and round South Cape, where it was caught in the north-running current and carried up the west coast past Horn sound. The filling and emptying of Stor fiord such as we saw it then is, I think, the normal state of affairs. In calm weather the polar pack, almost exclusively old floes which have stood the long buffeting of the passage across the Polar basin, drifts slowly westwards past the mouth of the fiord. A portion of this ice is held up against the southward-stretching western coast of the fiord, swings round and spreads gradually into the inner parts, where it is held by south-west winds until the first north-easter comes along, and once more sweeps the fiord clear of all except fast-ice. Then the slow filling by the irresistible polar pack begins again, and the whole process is repeated.

In 1920, however, the ice gave little trouble. All round Spitsbergen, in fact, it proved to be a very open year for ice, perhaps too open for our purpose, since on more than one occasion the heavy swells which came up Stor fiord made landing extremely difficult. Among the places visited under last summer's favourable conditions were Agardh bay, Möhn bay, various points on Barents island and on the northern portion of Edge

island, and Whales bay. The *Autumn* also ran some distance up Freeman strait till stopped by current and fast-moving pack, which made retreat distinctly the wiser course.

At all these places interesting changes were found in the condition of

Sketch-map of the Spitsbergen Archipelago.

the glaciers, compared with their state as laid down on the Admiralty Chart. At Whales bay and Möhn bay all the ice formations are in retreat; on Barents island the reverse is the case, and the two Anderson islands on the west coast are now swamped by the rapidly advancing Gregory glacier, which has its origin in the central ice-sheet. On both

Barents and Edge islands journeys were made inland on to the highland ice-sheets which occupy the central and eastern portions of these islands, and it is a noteworthy fact that on Edge island the ice was only reached after travelling for 10 miles up the wide open valley which debouches just south of Cape Lee. The comparative scarcity of ice on Barents and Edge islands was quite contrary to preconceived ideas, the available literature leading one to the belief that the islands are literally swathed in ice. In point of fact, it is only the central and eastern portions which carry any considerable accumulation. On the shores of Freeman strait, for instance, there are no glaciers except one coming in on the north shore from the Barents ice-sheet. For the rest both islands are cut up by wide, moderately fertile valleys, which afford excellent feeding-ground for the small remaining stock of reindeer. During our stay in the neighbourhood the weather was generally dull, and sunny days all too few, and that this is the general rule is borne out by the accounts of other travellers in the same region.

One of the main objects of the visit to Stor fiord was the revision of the coast-line as laid down on the Admiralty Chart, still based upon the work of Nordenskjöld in 1864. It was also our intention to run several lines of soundings across the fiord. This object was carried out to a certain extent only; but perhaps the most important result of the somewhat hurried survey was the elimination from the chart of the "low flat island" placed near Whales bay. On the site of this supposed island Mr. Mathieson found depths of 91 and 75 fathoms, and thus finally corrected an error which can be traced right back to very ancient Dutch charts. One supposes that such a mistake originated in the first place either by the misplacing of the shallow ground in Disco bay or by the presence of a grit-discoloured iceberg being mistaken for something more lasting. In either case, the main interest of the incident lies in the illustration it affords of the way errors may be perpetuated for hundreds of years and find their way on to the supposedly accurate charts of to-day.

It is a curious and lamentable fact, on the other hand, that this particular portion of Spitsbergen might have been, instead of the least, the most accurately mapped region of the whole island group. Twenty years ago Stor fiord was very thoroughly surveyed by the Russian Arc of Meridian Expedition; but the topographical results were never published and may now be regarded as lost. Fortunately the little that was done by our party last summer can be accurately plotted, for Mr. Mathieson was able every now and then to fix his position with reference to cairns erected as primary triangulation points by the latter expedition. The co-ordinates of these points were published before the war, but no detailed maps have yet been printed, and it is now extremely unlikely that such maps ever will appear. Procrastination has thus resulted in the almost complete loss of these valuable records. I say almost, for a much crumpled proof of the map of the northern portion of Stor fiord was found

in a waste-paper basket in Petrograd in 1916, was sent to Norway as a curiosity, and is now preserved there pending developments in Russia.

Wherever possible careful notes were made of the geology of this little-known area; for nothing definite is known beyond the geological map published by Baron Nordenskjöld in 1866 based on observations made during the visit in 1864. In the eastern and northern parts Triassic rocks lie almost horizontal; on the west side of the fiord, and particularly the south-west, however, rocks of Jurassic age are tilted, sometimes gently, at other times at a sharp angle, as for instance on Mount Keilhau. Here, in fact, are the truncated ends of folds produced by a mountain-building period in Tertiary times. This tangential movement has not until now been fully recognized, the view of Spitsbergen structure which is generally adopted being that of Prof. Nathorst, who holds that in Tertiary times there was no tangential movement but only faulting. This view, which has prevailed so long, can no longer be maintained; not only because of the thrust eastward of the peaked mountains of the west coast over much younger beds, but also in view of the overfolding of the Jurassic and Tertiary beds near the thrust plane, overfolds which shade off into sharp anticlines as one goes east, and are succeeded still further east by low flat anticlines, and these in turn by horizontal beds. The so-called table mountains so widespread in central Spitsbergen are actually in the majority of cases gentle anticlines. They are but the last faint tremors of intense crustal movements, not radial but tangential in direction. The result is a set of north-and-south folds, which make it probable that certain of the coal-bearing rocks of Ice fiord also reach Stor fiord. Those of Jurassic age certainly do; the more valuable Tertiary beds may. I have not seen Tertiary beds myself, but adequate proof seems to be afforded by a Tertiary flora collected many years ago from "Mount Hedgehog," which I take to be, not the real Mount Hedgehog climbed by Sir Martin Conway, but Muscovy mountain of the old charts.

Economically the Stor fiord is exploited almost every year by sealers. The past history of the region has indeed been one long record of nearly three hundred years' hunting in practically uncharted waters. In the early days whales and walrus were sought by the British and Dutch; in the eighteenth century Russian parties wintered for trapping; in the last generation Norwegians have occasionally wintered for bear and reindeer hunting and for fox-trapping; and visits are now paid annually by two or three sloops engaged in sealing. Not many bears, however, are killed now, even in winter, and reindeer are fast becoming rare on both Barents and Edge islands. One species of seal, however, frequents the shallow water of the fiord, and these are hunted in boats when there is ice-drift about, the seals being shot whilst lying asleep on the floes. In an open year there can of course be no such hunting; in that case the boats simply go farther afield where ice is to be found. Were it not for this limited sealing industry Stor fiord would be almost deserted to-day.

Glaciology.

The retreating glaciers seen in Spitsbergen to-day are the shrunken remains of a much thicker ice-covering. Indeed, it is not too much to state that they are the relics of a cap of continental ice probably more complete, in proportion to the size of the island, than that which covers Greenland at the present time. This former glacial period, suspected by many previous observers, is now a proved fact. Evidence has accumulated year by year until there is now no doubt that the extension of the ice in the past was incomparably greater than that of the present time. Let me quote two relevant instances from within my own experience. At Whales bay erratic pebbles of unknown origin can be seen lying on the hillsides of Jurassic shale up to at least 1000 feet above the present level of the glaciers. At Klaas Billen bay, again, the evidence is even more satisfactory. Dr. Robert Campbell, who was mapping there last summer, found gneiss erratics from the east lying on Carboniferous beds in Adolf bay 1400 feet and upwards above the present surface of the Nordenskjöld glacier: and on the other side of Klaas Billen bay erratics were found on Pyramid mountain at a height of 2000 feet. At neither of these places is the upward limit known. It may well be that the mountains were entirely submerged by the ice-cap at that time.

It is, however, one of the most striking and characteristic features of the physiography of Spitsbergen that there is little or no topographical evidence to bring forward in support of this undoubted former greater extension of the ice. The rounded contours which characterize the relief of other countries, which have been recently glaciated to any extent, are absent. Their place is taken by sharp jagged peaks and steep scree slopes, the latter being developed on a most unusually large scale. Rapid frost-weathering and the consequent accumulation of talus have entirely obliterated structures due to planation by glaciers. The former are characteristics of a phase of the working of denuding forces in frigid climates which is only just beginning to receive the attention due to it. Garwood and Gregory's statement that the serrated peaks at the mouth of Ice fiord prove the absence of any recent ice-cap over western Spitsbergen can no longer be accepted, as it is based on misapprehension of the factors actually engaged in sculpturing the countryside.

A proper appreciation of the past extent of the glaciation is imperative before any attempt can be made to describe the types of glacier seen in Spitsbergen at present, for the glaciers seen to-day are simply the lineal descendants of these former ice-floods. In earlier times the island was covered by a cap of continental ice, which must have swamped all irregularities of the land surface except perhaps the marginal mountains and possibly some of the higher peaks of the interior. On the few portions which escaped inundation by the main ice-cap, and this was probably only along the west coast, highland ice was locally developed. There is no part of Spitsbergen now which shows conditions at all com-

parable to such intense glaciation. Two parts only are heavily glaciated, New Friesland and North-East Land: on the first of these the ice is, properly speaking, a highland ice-sheet; whilst the ice-covering of the latter would be defined, in the classification adopted here, as a cap of island ice.

North-East Land has generally been described as an "ice-cap," and New Friesland as "inland ice." These terms, together with the so-called "Norwegian," "Alpine" and "Alaskan" glacier types, are the terminology of a previous generation. At that time the life-history of glaciers was not well known; to-day it is otherwise, and the results of numerous Antarctic expeditions have provided data for classifying and naming glaciers on sound genetic principles. The first attempt of this nature was made by Dr. Otto Nordenskjöld; a later attempt by Mr. Priestley is, however, more satisfactory and will be followed here.* This classification regards the ideal glacier as divided into areas of predominant supply, predominant movement, and predominant wastage. In the first the land surface is protected; in the second there is considerable erosion; and in the third deposition is the main feature. The types found in Spitsbergen are shown by italics in the following table, which is a slightly modified version of the classification put forward by its formulator.

Supply.	*Movement.*	*Wastage.*
Continental ice (cap)	*Valley glacier*	Expanded foot.
Island ice (cap)	*Wall-sided glacier*	*Piedmont.*
Highland ice (sheet)	(*Cascading glacier*)	Glacier tongue.
Cwm glacier	(*Avalanche glacier*)	*Confluent ice.*
Snowdrift ice		Shelf ice or barrier.

North-East Land is a case of island ice. Most Spitsbergen ice, however, even in New Friesland, is highland ice. By definition this is a thin but continuous ice-sheet with its upper surface conforming to a considerable extent to the major irregularities of the land on which it rests. Typical examples occur in the country east of King's bay, and between Horn sound and Stor fiord. Less perfect examples are the ice-coverings on the eastern sides of Barents island and Edge island; and the so-called "carapaces" which occur so plentifully in the plateau region. The former appear to be, the latter certainly are, the fast-dying remnants of what were once much greater sheets of true highland ice, spreading over the hills on both sides of Stor fiord. As regards the other types characteristic of the zone of predominant supply, cwm glaciers are frequent, and snowdrift ice, or what appears to be such, is several times recorded.

Ice in the zone of predominant movement is represented mainly by valley glaciers (the so-called "Alpine type") draining highland ice. Such

* Mr. Priestley's classification is embodied in the Glaciology Memoir of the Scott Antarctic Expedition, 1910–1913, now in course of publication. He has very kindly allowed me to use it here, besides making many other very useful suggestions.

glaciers may be comparatively large (*e.g.* the Nordenskjöld glacier in Klaas Billen bay) or else on a much smaller scale (*e.g.* the Gregory glacier on the west coast of Barents island or the Miller glacier on Prince Charles Foreland). Many of the valley glaciers are tidal, and end in steep ice-cliffs from which small bergs originate; others fail to reach the sea, and terminate, it may be, some distance up the valley. The distinction between tidal and non-tidal glaciers is not, however, important, as it depends usually on purely fortuitous circumstances bearing little relation to the size and importance of the glaciers. As regards non-tidal glaciers a steep cliff is regarded as pointing to the ice being in a state of advance, a low tapering snout to the ice retreating. This distinction was first pointed out by Professors Garwood and Gregory in their classic paper on Spitsbergen glaciers, and has every appearance of being well founded. I have not myself seen their type cases, the Booming and Ivory glaciers; and just at present it would be hard to find cases of "Chinese walls," for the low tapering snout characteristic of retreat is now the common type. Mr. Stevens, who saw Ivory glacier in 1919, has written to tell me that it no longer has a "Chinese wall." Both on the Fulmar valley and Agardh bay sides it shows moderately gentle slopes, easy to walk on; there is a small stretch of ice-cliff just where it enters Fulmar valley on the north-west side, but elsewhere the margins are smothered in moraine. These observations therefore show a very different state of affairs from what Sir Martin Conway found in 1896, for the latter very definitely states that the Agardh bay side could only be descended at one particular spot. One must therefore conclude that the Ivory glacier, which was advancing in 1896, is now in a state of retreat.

Garwood and Gregory went so far as to say that a kind of "over-rolling" went on at the front of an advancing glacier. I have always regarded Professor Garwood's photographs as good evidence of this; by others, however, this view is subjected to strong criticism: it was unfortunate therefore that "Chinese walls" are now so scarce as to have prevented this interesting point being properly verified. That thrusting does play a prominent part in glacier movement is generally admitted; that "over-rolling" also occurs has still to be proved.

The third area, that of predominant wastage, is represented by piedmonts and confluent ice. The best piedmonts seen last summer were the Monaco and Buchanan glaciers on the east side of Prince Charles Foreland. The former is fed by large valley glaciers such as the Murray glacier; the second is exceptionally interesting, because it is very largely nourished by wall-sided glaciers and by snow avalanches from the steep cliffs of the Monaco–Jessie range. The most striking of all the magnificent glaciers in Stor fiord is the Negri glacier at the extreme north end; both it and the Hayes glacier farther south are continually calving tabular bergs of typical Antarctic aspect. I regard the Negri glacier, however, not as a piedmont but as a case of what Mr. Priestley calls confluent ice, the

distinction between the two simply being that the latter may be afloat and have its shape determined by rock obstacles against which it has impinged. Glacier tongues and expanded-foot ice may also occur in Spitsbergen, but so far I have not seen any myself. On maps the Ivory glacier appears like a case of the latter; but Mr. Stevens tells me that on entering the Fulmar valley the ice presses against the opposite valley side and finds relief by flowing right and left; it can only be regarded therefore as somewhat modified expanded-foot ice.

In connection with glacier classification reference should be made to Dr. Otto Nordenskjöld's "Spitsbergen type" of glacier. After carefully reading his definitions I have come to the conclusion that he is describing a type intermediate between continental or island ice and highland ice. He says, "Almost completely ice-covered mountain regions, which from a distance show a regular ice horizon similar to inland ice, but in which the ice conforms in the main to the shape of the ground." * In Spitsbergen the only area which answers this description is New Friesland; North-East Land is covered by island ice, the rest of Spitsbergen by highland ice. The ice of New Friesland therefore is by no means typical of the country, and on that account should certainly not be taken as the type. At the same time, to judge from Captain Staxrud's narrative of his journey, the ice there appears to be only an extreme case of highland ice.†

In view of the objections to the topographical nomenclature, it seems more desirable to describe the glaciation thus: Spitsbergen is covered in the higher parts by sheets of highland ice having their outlet towards the coast as valley glaciers; as a rule these end as such, but in exceptional cases piedmonts and allied ice-formations are developed. This represents the diminished stage of a much more intense glaciation, and if it is considered desirable can be called the "Spitsbergen stage" of the glacial cycle.

Personally I have not made measurements of the rate of movement of any of the glaciers; last summer, however, Mr. Mathieson began measuring the rate of the Nordenskjöld glacier. It will be some little time, of course, before sufficient observations can be obtained to yield definite results. Reference can be made, however, to an excellent and authoritative piece of work already published on the rate of Spitsbergen glaciers by Dr. Adolf Hoel.‡ He measured the displacements of seventeen points on the Lilliehöök glacier in Cross bay, some of them no less than eight times during a period of five years. In July 1909 at points about 1½ km. from the margin and 1 km. from the terminal cliff the rate was

* Otto Nordenskjöld, Wissen. Ergebnisse d. Schwedischen Südpolar-Exped. 1901–1903, Bd. I. Lief 1; "Geographische Tätigkeit," pp. 177, 178.

† Arve Staxrud in A. Miethe: 'Die Expeditionen zur Rettung von Schröder-Stranz und seinen Begleitern.'

‡ Adolf Hoel, "Observations sur la vitesse d'écoulement et sur l'ablation du glacier Lilliehöök au Spitsberg 1907–1912," Kristiania Videnskap. Skrifter I. Math-naturv. Klasse, 1916.

80 to 90 cms. per day. Nearer the front of the glaciers the rate was about 10 per cent. higher. This is the same state of affairs as was found in Greenland, where the Great Karajak glacier moves 3 to 6 metres per day 5 km. from the front, but 7 to 12 metres per day close up to the front itself. The summer rate of the Lilliehöök glacier exceeds the winter rate only at the edges, where the ice is comparatively thin; in the central parts the difference is negligible. Since 1907, when observations were first made, there has been marked shrinkage of the ice along its margin; but it is only since 1909 that the rate of movement has sensibly fallen off. By 1912 the previous rate of 80 to 90 cm. per day had fallen off 40 to 50 per cent.

Dr. Hoel's work deals with a glacier in a state of retreat. It would be desirable therefore to have a similar set of measurements for an advancing glacier in these high latitudes, and also for a stationary type such as the Miller glacier on Prince Charles Foreland. The Nordenskjöld glacier, which Dr. Mathieson will continue measuring this summer, is probably retreating.

A feature noticed by practically all travellers to Spitsbergen in recent years is the fairly obvious fact that the glaciers are just at present in retreat. This is emphasized in the first place by the low gently sloping snouts, and in certain localities by a shrinkage away from the moraines. The absence of open crevasses is another indication; and on Prince Charles Foreland at any rate there are several slabs of dead-ice. It is probably an overstatement, however, to say that a tapering snout indicates retreat; many such are probably holding their own. Garwood and Gregory at the time of their visit mention the tapering snout as not being so common as the "Chinese wall"; in my experience the state of affairs now is just the reverse, and the only vertical fronts that I saw were on tidal glaciers where a steep cliff is due to an entirely different set of factors. Examples of glaciers with tapering snout are the Miller glacier, and others on Prince Charles Foreland; Ragnar glacier, Ebba glacier, and many others round Klaas Billen bay; Usher glacier at Möhn bay, Stor fiord, and practically all valley glaciers on Barents and Edge islands.

Reference has been made to dead-ice on Prince Charles Foreland. An interesting derelict of this nature is the ice-slab at the col separating the valley called the Gill from McNair's Corrie on the east. In the middle of July 1920 this ice was quite bare of snow, and it was clear that it was merely the shrunken remnant of an icefield which at one time fed glaciers flowing both east and west. Every year this ice must melt a little more till it finally disappears. Dead-ice at a col such as this suggests a ready explanation for Garwood and Gregory's astonishing conclusion that ice may form in Spitsbergen without the intermediate *névé* stage; for it is just possible that they were observing unmelted winter snow lying on similar ice-slabs. Everything, on the contrary, goes to show that there is the intermediate *névé* stage here in Spitsbergen as elsewhere. For a

description, reference may be made to Baron Nordenskjöld's account of the surface of the cap of island ice on North-East Land (A. E. Nordenskjöld, *Petermanns Mitteilungen*, 1873, pp. 444–453). In this connection therefore it would certainly be desirable for some one to re-visit in summer Garwood and Gregory's type localities, namely Fox pass, Bolter pass, and Flower pass (Garwood and Gregory, "Glacial Geology of Spitsbergen," *Quart. Journ. Geol. Soc.*, 1898, p. 200).

While the majority of the Spitsbergen glaciers are undoubtedly retreating, the reverse is true of certain individual ice-streams. This may happen even in a neighbourhood where all the other glaciers are retreating. The most notable cases at present are a glacier south of Mount Phipps on the west coast of Prince Charles Foreland, and the Gregory glacier on Barents island. Strong evidence of the advance of the latter is afforded by a comparison of the unpublished map made by the Russian Arc of Meridian Expedition in 1901 and Mr. Mathieson's map made last year. In the interval the ice has moved forward about 2 miles and completely covered the Anderson islands, on which hunting parties at one time used to winter; it now has the form almost of a glacier tongue.

In the case of the Foreland advance a possible explanation is exceptional nourishment by avalanches. Such an explanation cannot however account for the advance of the Gregory glacier on Barents island. Here there must have been a considerable increase in precipitation over the gathering ground from which the glacier takes its origin. Either the Gregory glacier is the first to show the effects or else the spate has already spent itself elsewhere, but still influences this the only large glacier on the west side of Barents island. I think the latter view is the likelier. The Hayes glacier across in Möhn bay, for instance, had already made a very striking advance, noticed by Dr. Bruce in 1909; but it is now retreating, though not yet back to the position shown on the Admiralty Chart. In somewhat similar fashion one of the Whales bay glaciers also shows advance compared with the Admiralty Chart, but last summer it had obviously retreated somewhat from the extreme position. On these grounds I consider that the Gregory glacier has also completed its advance, and may therefore be expected in the next few years to retreat and uncover the Anderson islands. The cause of this general advance a few years ago round Stor fiord may provisionally be put down as climatic. It should be noted that Garwood and Gregory recorded "Chinese walls" as commoner than tapering snouts in the Advent bay region at the time of their visit; this may have been due to a somewhat similar local "shake up" there in 1896.

One effect of the melting of the great ice-flood would appear to be the raised beaches found in all parts of Ice fiord. I am familiar at close quarters only with those in Advent bay and Klaas Billen bay, and more particularly at Eckholm point in the latter locality, where they perhaps reach their finest development. Traced up from Eckholm point to Bruce

city at the head of Adolf bay, successive beaches sink gradually to sea-level; three main beaches, apart from numerous subordinate ones, show this interesting feature. The only reason that can be put forward for this tilt of the beaches towards the head of the fiords, *i.e.* inwards to the ice reservoirs, seems to be the decrease in the ice load on the surrounding mountains. If this is the right explanation another peculiarity is explained. In Adolf bay the most important beach rises from sea-level at Bruce city to about 50 feet half a mile down the coast; on its surface are a continuous series of concentric ridges, each probably representing a storm beach, of which the lowest is the present-day storm beach. This fact I took to mean that there has been a steady rise of the land over a long period, which is still going on. This rise is considered to be the direct result of a slow steady decrease in the amount of ice in the interior, thus linking up the present glaciation with the former ice-flood. Occasional local advances at the present day can only be regarded as passing interruptions of an otherwise gradual retreat ever since the period of the last great ice-flood.

The Coal-bearing Regions.

Coal is at present being mined at five localities: at King's bay; at Cape Boheman; at Advent bay (where there are several mines); at Green harbour; and at Braganza bay at the head of Van Mijen's bay, Bell sound. This industry, which bids fair to outlast any hunting future, started in a very small way only about the end of last century. No real progress was made, however, till an American company commenced operations at Advent bay in 1905. Development both here and elsewhere was slow; but gradually the exported tonnage began to increase. Then came the war, and, as in many other industries, a slump took place. When things were at their very lowest all American interests were sold to Norway; just then, however, the tide turned, and since that date the export has more than quadrupled. At present Norway owns the mines at King's bay, Advent bay, and Green harbour; that at Braganza bay is owned by a Swedish company; and the small mine at Cape Boheman is Dutch owned. Large areas of coal-bearing rocks are held by British interests, but so far have not been extensively mined.

Some idea of the progress of the coal industry can be obtained from the fact that 30,000 tons were exported in 1910; 90,000 in 1919. The failure to increase appreciably the export figure in 1920 was due to two serious accidents last winter, one at Green harbour, the other in the big mine at Advent bay. Both were the result of coal-dust explosions, against which and other dangers no precautions or safety devices whatever had been employed in any of the mines. At Advent bay it was seven months before the resulting fire was extinguished and work in the mine resumed. This coming summer, however, the export figure from this company alone is expected to reach 200,000 tons.

Of all the little mining communities probably the most progressive is that just referred to, that of the Store Norske Spitsbergen Kulcompani at Longyear City, Advent bay. Progress was somewhat desultory during the period of American influence, but since 1916, when all rights were sold to Norway, rapid developments have taken place. Unfortunately there has been no town-planning, and the present huts are sited in what is one of the gloomiest valleys in the whole country. The company, however, have ambitious schemes in hand, and one of them is the establishment of new quarters at Advent point, the site of the old hotel twenty-five years ago. There is no reason why Spitsbergen mining villages should not be models of comfort. At present the main requirements are some form of drainage and improved water supply; in winter water is simply obtained by melting snow and ice from the adjacent not over-clean river-bed. The food consumed is all imported from Norway; an obvious improvement would be to rear large herds of reindeer in the more suitable valleys of the interior.

The future of the mines here and elsewhere must depend very largely on the Norwegian markets. Last summer the price of coal in Norway was £10 to £12 per ton; to-day it is down to about a third of that figure. There is a strong possibility therefore that, instead of the big exports expected this summer, there may be a much diminished output, and even a shutting down of some of the mines. Last year freights alone were £3 per ton. Any set back, however, can only be a temporary one. The future is bound to see these Norwegian and other mines annually exporting up to at least one million tons, the approximate amount of coal hitherto purchased from Britain each year by Norway.

Open unfettered markets will lead to competition once more between different qualities of coal. In this respect Spitsbergen has nothing to fear, as the following details of the seams will show. Coal in workable amount occurs at three geological horizons, in beds of Carboniferous, Jurassic, and Cretaceo-Tertiary age. So far no Carboniferous coal has been actually put on the market, but seams of workable thickness are recorded from Klaas Billen bay. It differs apparently from other Spitsbergen coals in producing a good hard coke; and its analysis is almost exactly the same as that of certain popular Scottish coals. Efforts to mine Jurassic coal have all so far proved a failure, and this is not surprising as it is very poor in quality and the seams are not very thick. Matters are very different in the case of the Tertiary seams: these are often 4 to 5 feet thick, but vary somewhat in quality; the best coals are, however, equal to good Welsh steam coal, and in Norway they are in fact preferred to the coal recently exported from this country. All the mines which have been successfully worked up to the present date are in Tertiary beds.

On account of the horizontal lie of the strata it should be a comparatively easy matter to gauge the extent of the coal reserves, once the

country has been properly mapped. Estimates of Carboniferous and Jurassic reserves are difficult to make at present, as these coals have not so far been exported. The Tertiary seams can be considered as mainly first-class reserves; but the estimate recently made for them in 1913 of 2000 million tons probably errs on the conservative side. Dr. Rudmose Brown's estimate, covering both Carboniferous, Jurassic, and Tertiary seams, is 9000 million tons, a figure which represents 30 to 40 times the amount of coal annually mined in Britain. Spitsbergen therefore can supply the Scandinavian and northern markets for many years to come. Whether she will ever supply this country with coal is much more open to doubt.

Before the paper the PRESIDENT said: I have the pleasure of introducing to you Mr. Wordie, a geologist who has been for many years interested in Polar exploration. He accompanied Sir Ernest Shackleton's Weddell Sea party, and will give us an account this evening of Spitsbergen, which he visited last summer.

Mr. Wordie then read the paper printed above, and a discussion followed.

Dr. RUDMOSE BROWN: I think it was on my third visit to Spitsbergen that I had the pleasure of Mr. Wordie's company, and it would be impossible to have had a better man for the work. He has spoken very modestly of his climbing feats. I do not mind telling you that he took a singular delight in running up mountains. He has said he went by the easiest way, but believe me I never knew a man more energetic in covering any kind of country in polar regions than Mr. Wordie. He has given us an account of only a small part of his work to-night. He was in charge of the party that completed the exploration of Prince Charles Foreland, on which Dr. Bruce was engaged for several years. I was with Dr. Bruce in this work some years ago, and I can assure you that the difficulties of exploring were very great. In contrast to the brilliant weather up the fiords, misty weather prevails on the west coast of Spitsbergen. There are very few fine days, and one can seldom see the tops of the mountains. Day after day one's attempts to survey are thwarted by the fog. Probably the reason why the low ground was so well done in Dr. Bruce's map and the higher ground was incompletely surveyed was the fog. Mr. Wordie has spoken of the low flat island which figures in the chart of Stor fiord. I wonder if the Admiralty will remove it from the chart? It must have been twenty years ago that the Prince of Monaco sailed over it and told the Admiralty it did not exist. It is extraordinarily easy to get an island put on to a chart, but it takes a great deal to remove it when once it gets there, even if "P.D." is put against it. As regards the retreat of glaciers, I think Mr. Wordie showed a photograph of a big glacier in Recherche bay, and I noticed last summer that the glacier had a totally different shape from some ten or eleven years ago. That glacier has retreated at a very great rate. I was only able to make some rough measurements, but it must be some 10 feet at least each year. The Nordenskjöld and Von Post glaciers are retreating. Baron de Geer, the Swedish geologist, measured them some years ago. Others seem to be advancing. I think the most extraordinary feature of the glaciers is the absence of glaciation in some parts of the country, like the well-known Sassendal and other valleys that afford ice-free routes into the very heart of the country, while further to the east there are glaciers, and again to the north,

south, and west. There seems to be an oasis in the heart of Spitsbergen at present free from glaciers. I do not want to talk much about the minerals in Spitsbergen, but I should like to mention one point in relation to Mr. Wordie's statement that the Norwegian and Swedish companies had done most of the mining development. It is only fair to add that during the years of war when the British fleet was protecting the merchant fleets of neutral countries, Norwegians and Swedes could continue their work, but British companies could not, and hence it is that the British territories in Spitsbergen are comparatively poorly developed compared with the Norwegian coal estates. There are a great many other things I should like to speak about, but just a few words regarding the ice. One peculiarity about Spitsbergen is that the west coast of the country is probably accessible throughout most of the year except in the early summer. Probably the worst time to get to the west coast is in May and June, because it is then that the polar ice breaks up, and the pack drifting across the Polar basin—that drift which Nansen took advantage of—sweeps down the east coast of Spitsbergen and then, getting into the Gulf Stream drift, turns northward along the west coast and often blocks that coast. The north-west of Spitsbergen may be comparatively open at that time of the year, and so results the peculiar fact that sometimes in the early summer the most approachable part is the north-west and not the south-west. In full summer all that ice disappears, and it is very unusual for the west coast to be invested with pack at that season. Of course, the east coast is quite a different proposition. August and September are probably the best months on the east coast, but you never know what it is going to be like. Some years when the west coast is late in opening, the east coast is comparatively free from ice. Last year on the whole seems to have been a very good ice year in Spitsbergen, and it is interesting to note that while the Spitsbergen coasts were very open the ice on the east coast of Greenland was particularly abundant. That may be a coincidence, but there may be some connection between the two facts. It would be of interest to correlate the ice distribution of other years, especially in relation to the distribution of winds, to see if there is any causal connection. I believe the head of Ice fiord is far more accessible than Mr. Wordie has suggested, because I think that in addition to July and August it would be open for the greater part of September. People who are mining coal in King's bay could probably export it throughout the year if it was not for the danger of navigating those seas through the winter darkness. I should like to express my great indebtedness to Mr. Wordie for his most interesting paper, and the extremely lucid way in which he has brought out so many points about a country which he and I admire so much.

Mr. A. TREVOR-BATTYE: When an old traveller is laid on the shelf nothing is more delightful to him than to be taken back again into the scenes with which he was familiar years ago. I must say one does rather rub one's eyes when one hears the lecturer talking of twenty or twenty-five years ago as "the good old days." Mr. Wordie has given us a most delightful lecture, and I think it may interest you perhaps a little bit if I were to tell you of the extraordinary contrast and difference between Spitsbergen twenty-five years ago and as one sees it now. When I see a population occupying those spots where one used to lie night after night in the sleeping-bags, it certainly does seem most remarkable. I should like to ask the lecturer to tell us about the present position of the reindeer. In those good old days the reindeer were so tame that when I used to be sketching they would come up behind me and stamp to try and make me move. I have a photograph of reindeer sniffing at the biscuit-boxes at the

entrance of a tent. That is a very different position of things from those now. What Mr. Wordie told us about the loss of an island from the advance of one of the few existing advancing glaciers was extraordinarily interesting. As a parallel case there was an advancing glacier at the head of Ice fiord ; it had covered an island which you will find on the old maps marked as such, but which we hunted for in vain ; the glacier was advancing so rapidly that one of the great seracs its snout cast into the sea made a wave so great that it washed our whale-boat high up on to the mosses and, retreating, all but lost us our boat among the grounded floes. We named this the "Splendid glacier," by which name it is now generally known. The coal-workings are most interesting to me, because we coaled up by getting a pick-axe and hacking at the coal on the surface of the ground in Advent bay, and there was no other human being in Spitsbergen excepting five Swedes or Norwegians, who, having been caught in the ice, had been there all the winter ; we took these men off. I do not know if Spitsbergen is ever likely to be a very prominent land for the tourist. At the same time, when the days are fine, there is no more beautiful scenery in the whole of the Arctic area than, for example, that of Magdalena bay. It is a very great pity that the exploration of these lands is accompanied by the slaughter of the fauna of the country, and I think the experiment with the Arctic fox would be an extremely interesting one, if any men could be found willing to endure the darkness of a Polar winter for the purpose. It may be interesting if I add, in evidence of the curious variation of the distribution of the ice from year to year in these latitudes, that we were able in a little iron Norwegian herring-boat to go clean round Spitsbergen without any obstruction.

Colonel Sir CHARLES YATE : I am not a geologist, nor have I been to Spitsbergen, but I have taken a great interest in it from the purely practical point of view as to what may be got out of it. I was therefore very sorry to hear the lecturer tell us that the English companies in Spitsbergen had not been exporting coal as yet. I think we all remember the various fine pictures we have seen in various illustrated journals during the last two or three years showing how the British exploring companies were getting on, and when I heard that no actual exporting had been done by them I must say I felt disappointed. I was very glad that the subsequent speaker was able to explain to us the reason why the British companies had not got on, and how it was owing to the war that the development of their mines had had to stand in abeyance, and I am hoping from what I have heard of the various exploring companies that their work will now develop and we shall see the British mines opening out rapidly. It is unfortunate that we had not got on the map shown us to-night, the claims marked out of the various British companies in comparison with the Norwegian and Swedish claims, because we have all had the idea that there is a very large tract of country which has been selected and marked out by these British companies as their own particular scene of work. I was disappointed to hear the lecturer say it was too far for coal from Spitsbergen to come to this country. When we hear now that coal is coming to Central Europe and France, not only from America, but even from Australia, it seems to me very curious that, if we have this really good coal within six days' sail of our own shores, a company developing coal in Spitsbergen could not land it in Europe much cheaper than can be done either by America or Australia. It was for that reason I always hoped Spitsbergen would become a British possession. I worked hard for that and tried my best to bring it about, but I was told by the Foreign Office at the time that their representative at the International Conference just before the outbreak of war, had signed a

paper to say that Spitsbergen was a *terra nullius*. That is one of the things the representatives of our Foreign Office do without the slightest authority. What authority had that man to sign a paper to that effect when we all know that Spitsbergen some two or three centuries ago was acknowledged to be British territory? We evacuated it, it is true, but no one had ever claimed it since, and the annexation that we made in 1630, or something of that sort, held good to the present day. However, the Supreme Council, as we know, have now assigned Spitsbergen to Norway. One of the first things that our lecturer told us this evening was that the Norwegians at the present time do not show signs of wishing to have Spitsbergen on their hands. I noted the words he said, because it was a rather curious way of putting it. I have always heard that what our mining companies feared in Spitsbergen was that they should be brought under Norwegian mining regulations, which apparently they had dread of. If the Norwegians do not want to have Spitsbergen on their hands, I only hope we shall all try to induce our own Government to make a fresh claim to resuscitate British rights in Spitsbergen and put the mines, of which we saw photographs on the screen, under British mining laws. For myself, I cannot say that Spitsbergen would not be of great advantage to Great Britain. We must remember that Germany evidently thought Spitsbergen was of considerable value, otherwise she would never have gone to the great expense of erecting her wireless telegraphy installation there. It is a very curious thing how Germany installed wireless telegraphy in Spitsbergen just before the war. We can well remember that Spitsbergen lies on the flank of our route to Archangel and the various routes of commerce to the north of Russia, and considering the large wood traffic we hope to get from Northern Russia, I see no reason why that route should not be greatly opened up in the future. Any Power who has Spitsbergen and could possibly establish a submarine depôt there would be a great menace to trade. Consequently, I have always looked on Spitsbergen as a valuable possession for Great Britain, even if it was simply to prevent any other Power having the possibility of establishing either a coal or submarine base in that territory. I join entirely with what the last speaker said in expressing regret that hunters have been allowed to go there and to exterminate the fauna. We must all regret it. One of the first things I think it is necessary for any Power that holds Spitsbergen to do is to establish strict game laws.

Mr. WORDIE: Mr. Trevor-Battye has asked about the reindeer. Nowadays there are very few in Spitsbergen at all. Those that there are are extremely tame, and would probably behave in just about the same way as they did with him. Sir Charles Yate was speaking about the possibility of bringing coal to this country, and instanced how coal had been brought all the way from Australia. It may be possible; but in the case of coal coming from Australia the boats get a return freight, while those coming from Spitsbergen must go back empty; and that is a serious drawback—that, so to speak, doubles the distance.

The PRESIDENT: My first remark must be in regard to the way in which islands are placed upon the map. Once placed there there is great difficulty in removing them. They are not exterminated from the map so easily as deer and foxes from the mountains. I found the same phenomenon as regards lakes in the middle of deserts. For many centuries lakes were put on maps of the desert of Gobi, so that when I went across in the year 1887 my route apparently lay along a series of lakes, but I found not a single lake. However, they still exist to the present day on maps. Mr. Wordie has tried to classify

glaciers, and certainly the glaciers he has shown us in Spitsbergen are very different from the glaciers in the Himalaya. As regards the general aspect of the country, I think it is most unfortunate that photographs are always grey. The general impression that one takes away after seeing a series of slides is that the country they depict is all grey and dull; yet at the same time we have speakers getting up and talking in raptures about the beauties of the country and how they would like to go back again and again. I cannot help thinking if we could have had some colour on these slides we should have had a very different impression than we have as to the attractions of Spitsbergen. As to the coal, as there are some thousand million tons there there is some little hope for us yet. As regards being able to get it, it does seem strange that we should be getting coal from so far off as Australia; but I hope that the coal merchants will have their eyes upon Spitsbergen. We in this Society did, as a matter of fact, during the war make a representation to the Foreign Office in regard to our claims to Spitsbergen. We wrote, I think, on two occasions, mainly at the instigation of Sir Martin Conway (who, I regret, is not present here this evening owing to parliamentary duties), who has persistently represented to us the importance of Spitsbergen. I am sure you will all like to extend to Mr. Wordie your thanks for his interesting paper and for the valuable remarks and observations which we have heard in regard to it.

THE MEKONG-SALWEEN DIVIDE AS A GEOGRAPHICAL BARRIER

F. Kingdon Ward

IN his "Orography of Asia" (*Geogr. Journ.*, February and March 1904) Prince Kropotkin says, speaking of the south-eastern border of the Tibetan plateau: "From these surveys we see that instead of the mountains running west to east or east-south-east under the names Tsin-ling-shan, Min-shan, etc., which were formerly traced in the south of the Hoang-ho, we have here the terrace-like slopes, marked by three escarpments, running due north-east to south-west, by which the plateau descends towards the plains of China. . . . It thus renders more and more probable the supposition which I formerly ventured to express with great caution only; namely, that the Great Khingan, which is the eastern border-range of the Great Plateau of East Asia, joins the Himalayas, and that consequently in the region (29° N., 117° E.) [100° E.?] where we have on our maps fan-like chains of mountains radiating between Salween, the Mekong, and the Blue river [Yang-tze, or Chin-sha], there are simply narrow gorges through which these rivers descend from the plateau."

From this it is clear Kropotkin believed, first that the Himalaya system and the Great Khingan are structurally connected with one another *to-day;* and, secondly, that there are *no* north and south trending ranges between the eastern Himalaya and the mountains of

western China, or rather the Great Khingan. What appear to be ranges of mountains, he says in effect, are simply furrows left between the grooves cut by rivers in their exit from Tibet.

On Kropotkin's map the Great Asiatic Divide is emphasized as extending in unbroken continuity from the Himalaya to Kamchatka; while the ranges thrust out eastwards from the Tibetan plateau between the Yellow river and the Yang-tze, as well as the ranges along the borders of Burma–Yunnan, are scarcely marked at all.

I shall endeavour to show that these conclusions are not justified by the known facts of distribution, for we need to consider, not only a geographical boundary trending east and west, but another one trending north and south for some hundreds of miles. It is this independent boundary formed by a great mountain range which Kropotkin completely ignores.

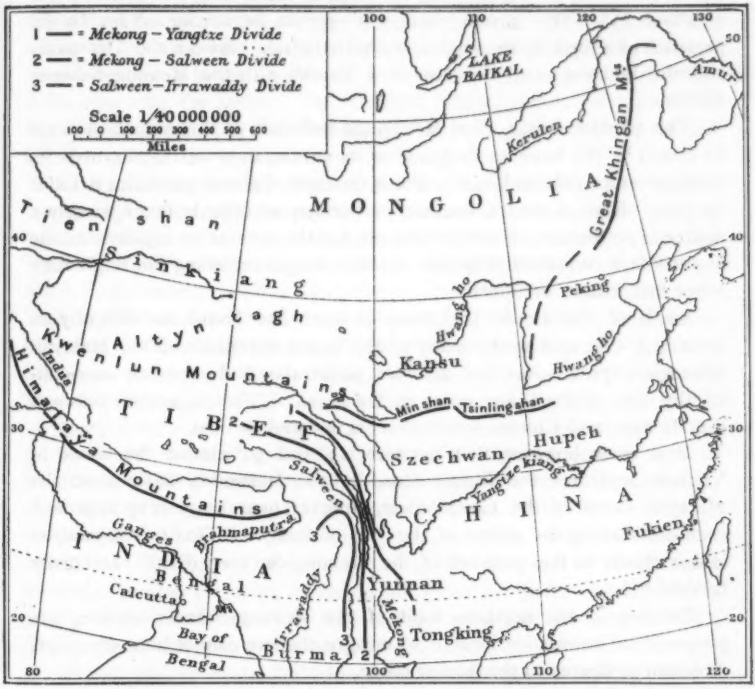
Though it would not be difficult to show that the parallel ranges along the Burma–Yunnan frontier, being largely built up of slates, schists, and other metamorphic rocks, tilted on edge, and striking about north-north-west to south-south-east, must have been an independent uplift, and are in fact features of original structure; yet for the purposes of our present argument I shall confine myself to conclusions based on the distribution of plants and animals as affected by the mountain ranges of south-eastern Asia.

I. Dealing first with the fauna, the Himalayan ranges, so far as they extend, form the boundary between the Oriental and Palæarctic regions. But east of the Brahmaputra bend, the boundary, uncertain though its direction is, clearly does not follow the supposed Himalayan extension as represented by the Great Khingan. Starting again from the Pacific end, we may perhaps pick up the lost boundary, recognizing in the Yang-tze river, or more probably in the Yang-tze–Yellow river watershed, the line of separation between northern and southern faunas. This boundary may be followed eastwards from the seaboard for some distance; but between the Brahmaputra bend and longitude 105°—some 10°—there is no clearly defined boundary. It is, in fact, lost in that very tangle of mountains whose claim to recognition we are trying to establish. These ranges break across the continuity of the east-west ranges in a direction from north-west to south-east, and it becomes necessary to consider the Palæarctic–Oriental boundary in two parts, namely, the Himalayan portion and the Chinese portion.

As regards the former it is sufficiently well defined; but the latter, especially towards the Pacific, where the mountains are much lower, allows a good deal of overlapping. Thus in the west the Oriental and Palæarctic regions are sharply marked off from one another; in the east they pass gradually into one another; while in the centre their boundaries are confused and indistinguishable.

South of this somewhat nebulous barrier the Oriental region stretches from the Arabian Sea to the Pacific. But if we travel eastwards south

of the 30th parallel, having crossed the basin of the upper Irrawaddy, abruptly we come to the limits of the typical Indo-Burmese fauna. For example, none of the following are found east of the Salween: Indian elephant, Javan rhinoceros, cat-bear (Ailurus), Malayan tapir, and two genera of monkeys, Pithecus and Hylobates. The faunas of the Indian and Chinese sub-regions of the Oriental region are in fact surprisingly different. The boundary between the two I have already indicated to be the Mekong–Salween divide. There is no sign here of that mingling of Palæarctic and Oriental forms we might expect from Kropotkin's idea



Sketch-map of Asiatic mountain chains to illustrate Mr. Ward's paper.

of grooves cut in the plateau; at least these supposed grooves have not served as highways of migration between north and south. Indeed, the tendency is to regard the tangled mountain system which intervenes between the Himalaya and the emergence of the Yangtze–Yellow river watershed—the district of Moupin, as it is called—as a separate sub-region.

On the other hand there is this sharp distinction between the eastern and western oriental faunas, which is not accounted for by any extension of the Himalaya.

Thus, according to the above facts, the boundary between the Indian and Chinese sub-regions should be drawn, not through the province of Bengal as was done by Wallace, but 10° to the east, coinciding with the Mekong–Salween divide; such a division has the additional advantage of corresponding with that between the Indo-Malayan and Eastern Asiatic floral regions. This sudden change in the character of the Oriental fauna as we go eastwards is worth noting carefully. In the valley of the Brahmaputra the Indian fauna, including the species named, extends to the 30th parallel, and in the Irrawaddy basin at least as far north as 29°. But in the valley of the Mekong an Oriental fauna does not extend north of about 23°. This abrupt change is only to be accounted for by the presence of a formidable north and south barrier between the Irrawaddy and the Mekong; and this barrier I identify with the Mekong–Salween divide.

The question arises, How far can the influence of this mountain range be traced? We have no evidence of its nature, as a barrier, towards its northern and southern limits. For a distance of about 500 miles it fulfils its part. Beyond that it becomes, especially as regards fauna, largely a matter of conjecture. South of latitude 24° the mountains rapidly dwindle in altitude, a complicated system of lesser ranges replacing the single high range met with in the north.

South of the tropic the fauna at least has found no difficulty in spreading east and west; many of the larger mammals of the Malayan sub-region spread over the southern peninsulas, and so in an ever-contracting belt up the China coast as far as 28°. The separation between the Malayan and Chinese sub-regions is not well defined.

It is clear, however, that between 23° and 30° almost the whole of Yunnan separates the Indian fauna of the Irrawaddy basin from the Malayan fauna of the China coast, however near these may approach each other along the shores of the Bay of Bengal. That this separation is due chiefly to the presence of the Mekong–Salween divide can hardly be doubted.

Turning to the northern limit of the Mekong–Salween divide, our geographical knowledge itself is so meagre that we cannot hope to assign direction or degree to the barrier range.

North of the 29th parallel the mountain ranges, here much higher, seem to trend away to the north-west, and we can only conjecture their relationship to the Himalayan axis east of the Brahmaputra gorge.

And here it is necessary to draw attention to a small point. I have said that north of the 23rd parallel in the Mekong valley there is no indication of an Oriental fauna; in the Irrawaddy valley, on the other hand, such a fauna predominates at least as far as the 29th parallel. The distinction is better marked with regard to the vegetation. The intervening valley, that namely of the Salween, partakes of both characters, and we can mark the change exactly as taking place at the 28th parallel.

Beyond that point, therefore, it is the Salween–Irrawaddy divide, not the Mekong–Salween divide, which constitutes the barrier between east and west. Geologically however it is probable that we cannot consider one range apart from the other. About lat. 29° this same Salween–Irrawaddy divide bends away to the north-west, and beyond the sources of the Irrawaddy merges into the Salween–Brahmaputra divide, which in turn no doubt takes up the burden of barrier range. But here again we enter into unexplored regions where it is rash to hazard too far.

II. Considering now the distribution of plants as affected by these opposing series of ranges, we are on surer ground. In the first place, owing to the more restricted distribution of species and genera amongst plants, we have a larger number of well-defined regions to deal with than is the case with the fauna. The Oriental (fauna) region corresponds to the Indo-Malayan, but the Chinese sub-region is cut off from it and becomes part of the eastern Asiatic floral region.

Between these two the Mekong–Salween divide forms a well-marked line of separation. To the west of this mountain barrier, in the basin of the Irrawaddy, we find species of Ficus, Garcinia, Pandanus, Englehardtia, Hiptage, Dipterocarpus, Shorea, Caryota, Calamus, and Musa; many Zingiberaceæ (Globba, Hedychium, Curcuma), Acanthaceæ (Strobilanthes), Melastomaceæ (Oxyspora, Osbeckia, Sporoxeia), Gesneraceæ (Chirita), Aroideæ, both climbing (Pothos, Raphidophora) and terrestrial (Arisæma, Amorphophallus); lianas such as Rauwolfia and Mussænda; besides numerous epiphytic ferns, orchids, and species of Æschynanthus.

Many genera and species of the above named are confined to the west side of the barrier. The typical Indo-Malayan orders such as Zingiberaceæ, Acanthaceæ, and Aroideæ, which are widely distributed in south-western Asia, are very poorly represented east of the barrier between the parallels of latitude we are considering; and this both in species and numbers. Turning now to the province of Yunnan, east of the Mekong, we find a number of plants which do not cross the divide to the west; it will be sufficient to mention *Chionanthus chinensis*, *Sophora viciifolia*, *Jasminum nudiflorum*, and *Ceratostigma Griffithi*.

As with the fauna, the Indo-Malayan flora crosses the barrier where it tails off in the south, and follows the China coast northwards; though for the latter the barrier appears to be effective over a longer distance perhaps as far south as the 21st or 22nd parallel. Moreover, there is a wide difference between the Indo-Malayan flora of Fukien and that of the Irrawaddy basin in the same latitude, separated by all the breadth of Yunnan.

To return now to Kropotkin's supposed Himalayan prolongation. As a zoological barrier, at any rate, this border range is of very unequal importance in different parts of its length; in the north-east it is not, in fact, a barrier at all. On the other hand, the despised China divide separating the basins of the Yellow River and the Yangtze, though ignored

in the Orography of Asia, is actually an important zoological boundary; for in the west at least it separates the Palæarctic region from the Oriental, according to accepted systems. And in this respect it is comparable to the Himalaya.

Beyond the Brahmaputra gorge there is *no* significant barrier stretching north-eastwards in the direction of Kropotkin's supposed border range. He himself, when describing the descent from the Great Khingan to the Pacific seaboard, though rightly insisting on the abrupt change in the vegetation, attaches undue importance to what is a mere climatic effect. He is not, as he supposes, passing from one floral region to another (still less from one faunistic region to another), but from one *formation* to another; namely, from steppe to forest. It is chiefly a question of rainfall and its seasonal distribution.

Thus it is impossible, having regard to the facts of distribution, to endorse Kropotkin's conclusions. On the other hand, there are indications, on similar grounds, of a *former* extension of the Himalayan axis north-eastwards into China; not necessarily following the alignment of Kropotkin's border range.

It is thus that we must account for the presence of a monkey belonging to a typically Oriental genus (Macaca) in Kansu. Similarly the small water shrew, *Chimarrogale styani*, is known by two examples, one obtained on the Salween–Irrawaddy divide, the other in Kansu.

Turning to botanical evidence, we find numerous species of plants common to these widely separated areas, the Burma–Yunnan frontier ranges and Kansu; *e.g. Lilium giganteum*, *Podophyllum Emodi*, and *Rosa sericea*. It is true that these plants are also found in the Himalaya; but their very occurrence there strengthens the evidence of a former extension of the latter range in the direction indicated.

Sir Isaac Balfour points out the contrast between the Szechwan rhododendrons and those of Yunnan, which separate along a line running more or less north-east and south-west—again suggestive of an original barrier separating a northern Ssuchuan flora from a southern Yunnan one. But in spite of the herculean labours of Sir Isaac Balfour in this fascinating field, so little is yet known concerning the enormous wealth of rhododendrons in that region, that it would be premature to stress the point. It may be that the contrast is due to climatic differences as between the rhododendrons from the drier regions of Szechwan, and those from the wetter parts of Yunnan, over against the Burma frontier.

We may therefore summarize our revised conception of the relationship existing between the Burma–Yunnan ranges and the Himalayan uplift thus:

(i.) The Burma–Yunnan ranges are features of original structure and not ridges left in the Tibetan plateau by the work of rivers.

(ii.) They form, for a distance of 500 to 700 miles, a dividing-line between the Indian and Chinese sub-regions of the Oriental (fauna)

region; and between the Indo–Malayan and eastern Asiatic floral regions. More particularly is this function performed by the Mekong–Salween divide.

(iii.) From the facts of animal and plant distribution, there is reason to believe that the Himalayan axis may at one period have been continued in a north-easterly direction.

(iv.) The backbone of China, under the names Min-shan, Tsinling, etc., being an important geographical boundary, would seem also to be the most natural extension of the Himalayan axis.

(v.) The Great Khingan is of no importance as a geographical barrier, and has no special claim to be regarded as a prolongation of the Himalayan uplift.

Arising out of the above, we may lastly consider the possible advantages and disadvantages of introducing a new faunistic and floristic region to embrace the mountainous mass of south-eastern Asia, between the lowlands of India and China; rather than, following the contours of the tangled ranges, divide them into narrow strips corresponding to adjacent and even remote regions. In the latter case they become outliers. It is objected with some show of reason that by introducing new areas to obviate the difficulty of overlapping along the borders of established ones, you do but increase the difficulty. No hard-and-fast line of demarcation can be found in any case; why then complicate the matter by recognizing two in place of one, each perhaps more imperfect than the one destroyed? The reply to this is obvious. Classification is simplification. With increased knowledge classification necessarily becomes more minute, proceeding from the general to the particular. As well object to the description of new species of animals and plants, on the ground that they can be more conveniently included in previously described species.

But we may go further than that, and point out that under existing systems the remarkable relationship connecting the Himalayan and Chinese floras is completely obscured by the introduction of floristic islands, surrounded and separated by more remotely related oceans of vegetation. The tendency is towards dividing up the animal and vegetable world into watertight compartments, forgetting that a mountain range is as much a highway of migration as a barrier.

We have therefore good grounds for recognizing in south-eastern Asia a new sub-region which may be called Sino-Himalaya. This would comprise the Himalayan and perhaps Trans-Himalayan ranges as far north as the Salween; the Burma–Yunnan ranges as far east as the Mekong down to the twenty-first parallel of latitude; and mountainous western China as far east as the province of Hupeh northwards to the Yellow river. This mountain region has a common flora and fauna, and is characterized by many endemic genera. It cannot conveniently be treated as part of the eastern Asiatic region on account of its strong

Indo-Malayan connection; similarly its Palæarctic connection is vitiated by its Oriental relationship.

On the other hand it is characterized by numerous endemic mammals, such as the takin (Budorcas), panda (Ailurus), Chimarrogale, Blarinella, Ochotona (mouse-hare), etc.; by many of the pheasant tribe, such as the tragopans, monauls, and blood pheasants; and by many genera of plants such as the Ranunculaceous genera Kingdonia and Beesia; Omphalogramma (Primulaceæ); Sporoxeia (Melastomaceæ); Leptocodon; and others. Whether future research will assign any orders of animals and plants exclusively or almost exclusively to this proposed region remains to be seen.

MOUNT EVEREST EXPEDITION

RECENT letters and telegrams received from the Expedition show that it has been possible to carry out very nearly to date the programme for the start of the Expedition from Darjeeling, in spite of unforeseen delays in the delivery of the stores, and still more unexpected breakdown in the transport train of mules lent by the Government of India. A few minutes before the beginning of the Anniversary Dinner the President received a telegram from the Chief of the Expedition saying that they had entered Tibet all well and sending hearty greetings to the Society.

But the confident expectation in which those at home were following in imagination the progress of the Expedition day by day was sadly interrupted by the distressing news that Dr. Kellas had died at Kampa Dzong on June 5 of sudden heart failure. His death at the outset of the Expedition is a serious loss to the party, for he possessed in a remarkable degree the power of mountain travel coupled with enthusiasm for the scientific investigations of the physiological effect of high altitudes, together with a talent for training coolies in Alpine work which had alone made it possible for him to carry out in the years before the war several noteworthy expeditions in the Himalaya. When in February last he accepted the Committee's offer of a place on the Mount Everest Expedition, he at once began enthusiastic preparations. At the beginning of April with four Sherpas he made the first ascent of the fine peak of Narsingh (19,130 feet), and during the last fortnight of the month made a sustained attack on Kabru, reaching what he describes in his last letter as the comparatively easy snow below the final peaks at about 21,000 feet whence he was compelled to return for lack of time. He reached Darjeeling only on the evening of May 10, to start on the 19th with the Expedition. Dr. Kellas had seemed to be an exception to the rule that men above fifty cannot stand the strain of prolonged exertion at high altitudes,

and many friends were confident that in spite of his age he would go as high as any one this year on Mount Everest. But it must be feared that he fell a victim to his enthusiasm, and that he did not allow himself the necessary rest and good feeding between the strenuous journeys he had been making almost without pause since his attempt on Kamet last autumn.

The preparation of the Expedition had been considerably hindered by the very late arrival of the S.S. *Hatarana*, by which the bulk of the stores had been dispatched in the middle of March. On May 10 Colonel Howard-Bury wrote that the vessel had been lying in Calcutta for a fortnight, but owing to the congestion in shipping she had been unable to get a berth or to land anything. When, however, soon after this date the ship was at last berthed, the stores were with the willing assistance of the Indian railways very quickly delivered at Darjeeling.

A letter from Mr. Mallory, who sailed with the scientific equipment and the balance of the stores by the S.S. *Sardinia* on April 8, showed that this ship had also been considerably delayed, and he said that it might be necessary to land at Madras and proceed by railway, instead of going on to Calcutta. What happened in this respect is not yet clear, but he and his forty odd cases of "personal luggage" seem to have arrived in time at Darjeeling.

Mr. Raeburn reached Darjeeling soon after the middle of April, and had been able to collect a good number of Sherpa coolies, several of whom came from a village just south-west of Mount Everest, and had been north of the mountain as far as Tingri. A letter from Colonel Howard-Bury dated May 18 said that that morning he had dispatched the first part of the expedition with fifty mules and attendants, seventeen high-level coolies (all Sherpas), two Lepcha coolies, two cooks, and an orderly. The remaining fifty mules and twenty-two coolies were to start on the following day. He had been unable to obtain for his clerk any hillman with a knowledge of shorthand or typing, but hoped to have as interpreter a nobleman of Sikkim who would meet the Expedition at Kalimpong.

The Expedition considered itself fortunate in obtaining a loan from the Government of India of 100 mules selected from the depôts at Sialkot, Amritsar, and Meerut. So long ago as February 28 the Quartermaster-General in India had given instructions for the selection of the best obtainable in each of these depôts, sturdy small-sized mules, suitable for mountain travel, and fully trained for pack-work. Staff-Serjeant J. R. K. Taylor, Supply and Transport Corps, was to be in charge, and the personnel included a troop duffadar, three naicks, thirty-nine lance-naicks and drivers, two saddlers, one blacksmith with a knowledge of carpentry, one shoeing-smith, a cook, a bhisti, and a sweeper. Precise instructions were given for the selection of the best and most reliable personnel and animals, and General Officers Commanding-in-Chief were

asked to depute their inspectors of Supply and Transport to satisfy themselves personally that the best possible selection had been made.

It was natural therefore to feel that the transport was as near perfection as could be, and that in this respect the Expedition would have an enormous advantage over any previous Himalayan expedition. The transport mules arrived in good time at Darjeeling, and were described as a fine-looking lot—plump and sleek. It was therefore with much surprise and great disappointment that the committee learned from the Chief of the Expedition that the transport had broken down badly only a few days out from Darjeeling. The mules proved soft and quite unaccustomed to work in the hills. By the end of five days they were hardly in a condition to carry their own line-gear, and it became necessary to hire local animals to replace them. A letter from Colonel Howard-Bury, dated "Sedonchen, May 23," seems to imply that he might find it necessary to rely entirely on local mules and ponies accustomed to the Chumbi route.

This unexpected breakdown must have been very embarrassing to the Expedition, and has caused some anxiety to the committee. When in the course of correspondence it became clear that the Expedition would have to bear a considerable cost arising out of the loan—for field allowances, for outfit, for separation allowances, etc., there was always the consolation that at any rate the transport would be above reproach and the principal anxiety of the Expedition removed. Even when the committee learned that they would have to hire a hundred mules to lend to the Government of India to replace those lent to the Expedition, it was still possible to think with satisfaction how much superior Government mules must be to those hired to replace them. But when we learn that still another hundred mules must be hired to replace the broken-down transport in the Tista valley, it becomes a matter for humorous consideration how much the loan of Government transport will eventually cost the Expedition.

It was of course inevitable that the great difficulty would be in the start, in the rainy season, in the horrible climate of the Tista valley: once over the Jelap La in the Chumbi valley the conditions improve very rapidly. The telegrams which have been published in the *Times* on June 14 and 15 dated respectively from Sedonchen and Phari showed that in spite of all troubles of transport and weather the party were in good spirits and making excellent progress. They had planned to be at Kampa Dzong on June 1, travelling in two divisions, and we know that the second division must have reached that place within two or three days of the scheduled time, because of the sad news from Kampa Dzong on the 5th. From Kampa Dzong to Tingri is unknown country, but reported easy going. There is every reason to hope that the reconnaissance of the mountain approaches will have been well in hand before the end of June.

REVIEWS

EUROPE

The Story of the English Towns: Pontefract, by **J. S. Fletcher,** pp. 128; **Harrogate** and **Knaresborough,** by **J. S. Fletcher,** pp. 124; **Birmingham,** by the Rev. **J. H. B. Masterman,** pp. 106; **Plymouth,** by **A. L. Salmon,** pp. 119; **St. Albans,** by **William Page,** pp. 114. London: S.P.C.K. 1920. *4s. net each volume.*

To the geographer this history of Pontefract is of interest as a record of the influence of a dominating military position on the foundation and fortunes of a mediæval borough. The fact that Pontefract owed the whole of its historic importance to its commanding location has impressed itself even on the author who could ignore the geographical factor in his accounts of Leeds and Sheffield (reviewed in this *Journal*, April 1920) and of Harrogate and Knaresborough. We have here a direct statement of the position which made the castle hill—looking northward across the River Aire in the short stretch between its confluence with the Calder on its emergence from the foothills of the Pennines and the Humberhead fenland—the site of one of the greatest mediæval fortresses in England. It is not very close to the easiest crossings over the Aire—Ferrybridge and Castleford enjoy that advantage—but as a fortress site it had no rival in the district, and so became the key to this important gateway between the Pennines and the Humber which connects the English Lowland with the Vale of York.

Most of this volume is devoted to a record of the part which Pontefract Castle played in English history between the Norman Conquest and its demolition in 1649 at the close of the Civil War. The market and industries, including the small but peculiar liquorice industry, are dismissed in a couple of pages; though the wide influence of its market is clearly a direct result of the nodality of the position and deserves careful analysis. In modern times the drainage of the marshes to the east has allowed the main line of the East Coast Railway to Scotland to pass ten miles east of Pontefract and the Great North Road, and the place has lost much of its former importance.

The volume on Harrogate and Knaresborough is a pleasant gossipy chronicle of local affairs in two boroughs which, until the rise of Harrogate as a modern watering-place, were never of more than local importance. Harrogate is one of a very interesting class of modern towns which are primarily residential centres or health and pleasure resorts of the well-to-do. It is also to some extent an outlying suburb of Leeds and Bradford. It is to be hoped that we may some day have a thorough study of some such residential town: this volume does not even state the distinctive economic and social basis.

In Canon Masterman's study of Birmingham we welcome a serious attempt to outline the development of one of our large modern industrial cities, and thus an important contribution to the study of town development. In the absence of any attempt to consider the geographical factors involved, it shows the weakness inherent in regarding a town as a growth independent of the Earth—on which every human group is directly dependent. But until we have students who are geographers as well as historians we are not likely to get a better study of its kind than this is, within so small a compass.

The geographical problems of the location of Birmingham are of special interest. It is, we believe, unique among the really large cities of the world—cities of the order of a million or more inhabitants—in that it is neither on the coast nor in a valley of any size: the city is actually astride the main water-

parting of England, between the drainage-areas of two of the chief rivers, the Severn and the Trent. In spite of its location by the headwaters of the insignificant stream of the Rea it is essentially a city set on a hill, and this position affects all its modern communications adversely: it is aside from the main line of the L. & N. W. Railway, and the chief lines climb to it up difficult gradients such as that on the Midland line from Bromsgrove: its canals are similarly handicapped by the relative altitude and the resultant difficulty of maintaining the water supply to the summit levels. Birmingham does not possess any obvious advantages of natural position over several other towns of the Black Country, which were equally accessible to the iron ore, the charcoal of the surrounding forested vales, and the coal: hence most writers on the city agree with Canon Masterman in ascribing its growth mainly to the energy and enterprise of its early citizens. In the 'Handbook to Birmingham' published for the visit of the British Association in 1913, Dr. John Robertson refers (p. 159) to the occurrence of fine sand suitable for casting as a factor of some importance. Such a small advantage over neighbouring sites, if sufficiently definite, may well have accounted for an early concentration of some metal industries here, and so have sufficed to give Birmingham the start among the Black Country towns. Its present importance is largely the result of that early start and the artificial nodality which it has thereby acquired.

Mr. Salmon's book on Plymouth is a straightforward account of the local history of the "Three Towns" and its development into one of our chief naval stations. There is frequent reference to the sea; but, curiously, none to any definite sea routes or to any land ways, so that there is here, as in most of the volumes of this series, no analysis of the location of the town. We agree with the author that Plymouth is the capital of the West Country, using that term as he does to indicate the peninsula of Devon and Cornwall; but we regret that he has not attempted to justify this claim as against the rivalry of Exeter, which would have involved a study of the locations of the two cities.

In Mr. Page's volume on St. Albans we get a worthy companion to Canon Masterman's on Birmingham. The book does give, though in a scattered and incomplete form, some account of the position and also of the sites of the successive towns of which St. Albans is the present-day representative. There is a clear and brief history of the Abbey; but to the geographer the chief interest lies in the results of the situation of St. Albans at the north-western gate to London, between the high ground of the Chiltern Hills and the marshes of the Lea valley. To this position is due the strategic importance of St. Albans in English warfare, and its present importance on the railways. In our own days the spread of London's suburbs has reached out to St. Albans, and in common with many of the older towns of England it is losing its distinct individuality and, like Pontefract, becoming a minor node in a larger urban region.

Four of these volumes have street plans inserted as end papers, and in two cases, Harrogate and Knaresborough, and Plymouth, there is a map—though a poor one—of the surrounding country. Out of eleven plans and maps in the five volumes only one is supplied with a scale. Generally speaking there is no reference to these plans and maps in the text; and it seems that neither the authors nor the publishers regard them as integral parts of the books. In the two cases—Pontefract and St. Albans—in which the author does note the position of the town his description suffers from the lack of any map of the neighbourhood to illustrate it: neither of these descriptions can be followed

adequately without reference to a map of the area on a fairly large scale, larger than that which is likely to be found in any general atlas, so that these are clear cases for the insertion of at least an illustrative diagram map.

C. B. FAWCETT.

Highways and Byways in Northumbria.— **P. Anderson Graham.** London: Macmillan. 1920. Pp. xviii., 370. *7s. 6d. net.*

To any one who knows Northumberland this book supplies a succession of most agreeable reminiscences. To a person unacquainted with the county, its rural charm and the extensive and varied interest of its historical remains may come as a pleasant surprise. By describing his tramps along the courses of the rivers, and on the coast from Berwick to Newcastle, the author is enabled to give a first-hand, intimate account of the nature of the country, the towns, villages, castles, churches, antiquities, and historical associations in a very picturesque and interesting manner. Mr. Graham is evidently steeped in a knowledge of the county, and has a strong affection for it. He is thus able to bring home the fascination of its streams, woodlands, and hills, the border warfare, nature love, and old times in a way which can hardly fail to communicate some at least of his own enthusiasm to the reader. In this he is assisted by the delightful illustrations from the pencil of Hugh Thomson, who, alas! will no more charm us with further additions to his unique sketches of old-time England. A map is added by means of which the different routes taken by the author can be followed.

E. A. P.

ASIA

Cyprus under the Turks; 1571–1878.— **H. C. Luke, B. Litt., M.A.,** Commissioner of Famagusta. Oxford University Press. 1921. 8vo. Pp. x., 282. *With Map. Price 8s. 6d. net.*

The Turk has made a good deal of history; but he does not write it, nor has he offered much encouragement to those who would pry into his affairs. Cyprus under the Turk is no exception to this; after the copious chronicles of its Lusignan dynasty, there is only the single printed history of Kyprianos, published in 1788, with a few descriptions by European travellers, and incidental references to the Greek rising in 1821, until the British occupation in 1878. Cobham's 'Attempt at a Bibliography of Cyprus,' and his 'Excerpta Cypria,' indicated and made accessible the more important documents; but only to disclose the void. Now, however, it has been possible for Mr. Luke, than whom there could be no more competent editor, to compile from the archives of the British Consulate in Cyprus, which begin in 1710, a remarkably graphic illustration of the way things went on under Turkish rule. It has been a laborious undertaking, for the documents are over ten thousand in number, in seven languages, exposed to all the ills which affect written matter in the East,—even in consular archives. For the period before 1710, there are papers from the Cyprus Vice-Consulate of the Levant Company, preserved in the Aleppo Letter Books, which have already been studied by Mr. G. Jeffery in *Notes and Queries* (20 and 27 March 1915). The earliest of these belongs only to 1626: and their historical interest is mainly incidental. It is not, of course, till comparatively recent times that official thirst for formal information was stimulated by public opinion in the West; but in 1867 the House of Commons asked for papers showing "how the stipulations agreed on . . . with regard to the treatment of the Christian and of the Greek subjects of the Sultan" (a delicate distinction!) "have been observed"; and the response, so far as Cyprus is concerned, was a valuable despatch from Mr. T. B. Sandwith—

traveller, scholar, archæologist, as well as a most skilful diplomatist—which Mr. Luke prints in full, with the answer to supplementary inquiries. With the British occupation in 1878, of course, the Consular Archives close; but without dealing with the succeeding period of administration, Mr. Luke has very properly closed his narrative with the Order in Council of November 5, 1914, by which the Turkish connection with Cyprus was terminated. The necessary consular lists, bibliography, and a sketch-map complete a volume which fills a real gap in our knowledge of the Levant, and fills it very well.

J. L. M.

Topee and Turban; or, Here and there in India.— Lieut.-Colonel H. A. Newell, I.A., F.R.G.S. London: John Lane. 1921. *Illustrns.* 21*s. net.*

Convention, in the Indian Bazar, has long designated the European by his headgear, and a flattering tribute to the impartiality of British administration takes the form of the clamour by litigants for "topiki dohai," the justice of the Hat. It might be surmised, therefore, from the title of this work that we have here a disquisition upon the relations between the foreigner and the native of the continent. This misapprehension, however, is dispelled by the sub-title. The author has to his credit a goodly series of handbooks to the more well-known cities of India, and in this volume he takes his readers "here and there" on excursions into fields less favoured by the general tourist.

The main thread of his narrative is the impression left on India by the successive waves of foreign influence which have passed into it and been more or less assimilated. This impression, he holds, tends to be deeper and more apparent on the country-side than when condensed into the complicated and less stable life of the city. His aim here is to give cursory glimpses of the traces of these varying types of civilization, with bits of archæology, tradition and history thrown in as he goes along. His range extends from Kashmir to the south Coromandel coast, with a glance at the Maratha Deccan, Mysore, and the Nilgiris. In some cases the way has been well trodden by previous writers, and here the padding is too prominent, and the writer is generally too prolific of the details incidental to motor-car travel. But he is a keen observer, and a practised hand at retailing what he has seen in a pleasant and telling way.

To those who went over the same ground a generation or more ago, the difference in both the locomotion and the conditions of travel in general will suggest some queer reflections. In a vivid little paragraph in which the author sums up a visit to an old historic cantonment abandoned some years back, and now in ruins, he remarks that the surroundings may be of India, but the presiding spirit is that of the dead Men of the West, who have left something of themselves and of their times behind them. What is the message for posterity contained in the new network of motor roads, with their bountiful endowment of turnpikes, signposts, and red triangles, which bulk so largely in the India of the author?

J. A. B.

The Rebirth of Korea.— Hugh H. W. Cynn. London: S.P.C.K. 1920. 10*s.* 6*d.*

The chief value of this volume lies in the picture it gives of the sudden growth of a certain national consciousness on the part of the Korean people, and of the results to which the movement has led.

As the result of some forty years' work by Christians Missions, over three hundred thousand adherents have been enrolled. Educated, mainly, in the schools of the *American* Presbyterian and Methodist Churches, they are

strongly impregnated with modern democratic ideals. This fact is, not unnaturally, exceedingly unwelcome to the Japanese Administration. A too trustful reliance on what the author terms the "soaring ideals" of President Wilson, as to the rights of "self-determination for the smaller nations," led to the so-called "Declaration of Independence" on the occasion of the obsequies of the late Sovereign, on 1 March 1919, when it was announced that "Korea is now an independent State and her people are free!"

These are the events that give the book its title. As to the alleged undue severity with which the Japanese Administration has sought to repress the movement, this cannot be denied, and it is in part acknowledged by the authorities themselves; but it should be remembered that this has often occurred, under similar circumstances, in the history of Japan itself. Still, it is clear that the police and gendarmerie, ignorant of the language of the insurgents, frequently went beyond both the orders and the wishes of their superiors. It is hoped, and probable, that the reforms and ameliorations promised by the Governor-General will be carried out, speedily, in a generous and sympathetic spirit, and that, with increasing mutual understanding of each other's language and character, a happier state of affairs may result.

Incidentally, the book throws interesting light on the civilising effects of Christian Missions in a land where its own ancient faith had largely lost its power to uplift its people. Christian hospitals have served to break down class prejudices by treating all on an equal footing. It was in the Industrial Department of the Mission School opened in 1886 under royal patronage as "The Hall for the rearing of useful men" that the first Korean periodical in English, *The Korean Repository*, was published, followed later by the first Korean daily newspaper. Finally, on the status of women in Korea, the teaching and practice of Christian ideals have exerted an influence that cannot possibly be exaggerated. W. W.

AFRICA

The South African Commonwealth.— Manfred Nathan, K.C, LL.D. Johannesburg and Cape Town (London: Hodder & Stoughton), 1919. Pp. xii. and 483. 30*s. net.*

The author of this book states that his object is to "present a general view of the constitution, political and general problems, and social conditions" of the Union of South Africa in the light of the ten years' experience since the Union was established. Mr. Nathan is himself a South African and has a wide knowledge of its peoples and problems. He has also the advantage of a trained legal mind and the gift of lucid expression. The result is that we have a study of the constitution which is admirably clear and tells exactly what one wants to know. We see a young community—for South Africa politically is young—working out its government on lines more logical and symmetrical than those of the other Dominions. This part of the book is followed by chapters dealing with trade, communications, finance, education, and politics. There is a thoughtful chapter on the native problem, which Mr. Nathan rightly recognizes as the most serious question with which the rulers of South Africa are faced—far transcending in importance the racial exclusiveness of part of the Dutch community.

The last part of the book describes social conditions, and here due regard is given to those geographical and climatic conditions which fundamentally affect South African life. The little pictures of town and country are admirable; there is a frank chapter on the capitalists and a candid discussion on the lack

of any really noteworthy South African literature. It will be seen that Dr. Nathan's book has a comprehensive scope; it is a work which none interested in South Africa should neglect to read. F. R. C.

Empire and Commerce in Africa.— Leonard Woolf. London: Labour Research Dept. and George Allen & Unwin. [1920.] Pp. 374. *Sketch-maps. Price* 20*s.*

In the judgment of the author of this book the general effects of European policy in Africa have been "almost wholly evil." He deals with events since "the scramble for Africa" began, and he attributes most of the evil he perceives to the exploitation of the continent and its peoples by the white man "to promote his own economic interests." It is a commonplace that economic interests provided the leading motive for the partition of Africa, but we do not make any attempt here to consider the truth or otherwise of Mr. Woolf's indictment.

While his bias colours throughout his interpretation of events, the author gives a well-informed account, well provided with references, of the struggle among European Powers to acquire territory or influence in North, East, and Central Africa. For this purpose the book is of value as a work of reference. It is not however free from error. It is inexcusable ignorance to describe Tripoli before the Italian conquest as "another Regency [like Tunisia] nominally under the Porte and ruled by another Bey." The description of the mainland dominions of Zanzibar as a continuous strip of territory is also an error which might well have been avoided. And a search through newspaper files would have saved the author from expressing doubt as to the date of the death of King John of Abyssinia, and building up an argument on the point in connection with the Treaty of Uccialli. John was killed in March, not November, 1889. The news was published in the London Press in April of that year. F. R. C.

AMERICA

Seeing the Far West.— J. T. Faris. Philadelphia and London: J. B. Lippincott Co. 1920. Pp. 304. *Illustrations and Maps.* 25*s. net.*

"Most Americans need to wake up to the fact that in their own west is scenery that is beyond comparison." That sentence of the author is the keynote to the book. He describes many of the most picturesque and interesting regions in the western United States from Puget Sound and the Yellowstone Park to the Mexican frontier, and he seldom lets us forget that the scenery is "beyond comparison." There is interesting matter in the book, but the continual hyperbole is irritating. The illustrations are well chosen, and there is an appendix with maps giving the national parks, monuments, and forests in the west.

La République Argentine.— Pierre Denis. Pp. 299. Paris: Armand Colin. 1920. *Price* 14 *fr.*

This volume is a worthy companion to the author's earlier book on Brazil, and will enhance his already high reputation as a geographer. As the subtitle, 'La Mise en Valeur du Pays,' indicates, it is primarily a study of the colonization and economic development of Argentina; and the order of treatment of the several regions is largely that of their settlement. In his introduction the author states that he has adopted this plan in preference to a more strictly regional treatment because of the newness of the country and the resulting fact that the population has not had time to develop *in situ* in relation

to its environment, but is still largely an immigrant population engaged in the preliminary "colonial" stage of exploitation of the more easily accessible resources. Only in the few longer settled areas is there yet any development of that varied adaptation to the land which characterizes the settled population of "old" countries. The work is essentially geographical in that the activities of the people are clearly set out in relation to the factors of climate, soil and accessibility which have guided the development of each type of exploitation; and the result is a logical and convincing book which well justifies the plan chosen.

The volume opens with a valuable chapter on the natural regions, each of which has been developed in relation to the rest and to Europe, since European colonization has been a dominant factor; so that these varied regions have been from the first interdependent in their economic life. All nine chapters are of interest; but here we may note in particular iii., vi., and viii.

Chapter iii. deals with the industrial cultures centred on Tucuman (sugar) and Mendoza (wine) in the irrigated valleys of the semi-arid north-western region, and describes the growth of these towns on the two great roads which were the axes of the Spanish viceroyalty of La Plata, and of Argentina before the middle of last century. These were the road to Peru, stretching from Buenos Aires to the mining districts of the Bolivian Andes, and the road to Chile, which branched from the former some 500 km. west of Buenos Aires and stretched westward *viâ* San Luis and Mendoza. The relation of the industries to the climatic conditions of these high-lying oases and to the supply of the mining population to the north and west and the lowlanders to the south-east is well brought out, as well as the crowding of population on the small irrigable areas in the midst of almost unpeopled scrub or desert, with the resulting early development of urban life.

The sixth chapter, "La Plaine Pampéenne," is an excellent study of a very definite region, never losing touch with the physical bases of the geography. It describes the colonization, almost all accomplished since the introduction of railways, of the eastern grassland. This is a region of simple and monotonous soil and climate, a rich alluvial plain interrupted only by a few detached low outcrops of older rock which are the visible summits of an earlier landscape now buried under the widespread alluvial deposits. Since the rapid spread of introduced European grasses the pampas plain has become a rich grassland fading into semi-desert on its western margin. The rapid development of this region in the last fifty years, like that of the corresponding grasslands of North America, has been due first to the growth of vast industrial populations in Western Europe, and hence of a demand for meat and cereals, and second to the development of cheap bulk transport in the form of steamships and railways. The pampas were first a cattle-rearing area, because cattle could be easily driven to the ports for export; now that improved transport and increasing population has made it possible to use the land more fully it is mainly devoted to wheat and maize, while the cattle ranches are being pushed back to less fertile and accessible land.

The account of the Paraná and its development as a great waterway given in chapter viii. is one of the best geographical studies of a great river that has come under my notice. It is surprising to meet the statement that the Paraná is now the best known of all great rivers (p. 244): this is a well-deserved tribute to the work of the Argentine Hydrographic Survey. The location of the river-side towns is described in so far as it is affected by firm sites and favourable conditions for landing goods, a very important factor along

a river which is constantly shifting its channel in its flood plain deposits ; but the author seems to have missed the influence of the position at the great bend on the growth of Rosario, now the second city of Argentina, with a quarter of a million inhabitants.

The last chapter is devoted to a summary account of the distribution and movements of the population. The recency of the peopling of the country is indicated by the high proportion of foreign-born residents recorded by the census : this reaches 30 per cent. for the whole country, and exceeds 50 per cent. in some important districts. Most of the immigrants have come from the Latin countries of Europe. Argentina has shared in the townward movement which has been so marked a social fact throughout the lands of Western civilization in the last generation. In 1895 37 per cent. of the people lived in towns of more than 2000 inhabitants ; in 1914 the corresponding figure was 53 per cent. ; while Buenos Aires with its suburbs now contains about two million inhabitants, and so ranks among the ten or twelve largest cities of the world.

One matter for regret is that the book is very inadequately illustrated. The seven diagrams given are clear and useful, but many more are needed. It is difficult to follow the detailed accounts of the pampas and the rivers without adequate maps, and no general atlas is likely to supply these on a sufficient scale. It is to be hoped that in the second edition, which should be reached soon, this lack will be remedied. There is a full bibliography, with critical notes, but no index.

To many people in this country and the overseas Dominions the book will be of special interest as an able and thoroughly scientific study of a country which presents many close resemblances to large parts of Australia, South Africa, and Canada in its economic conditions and stage of development. It is a work which no serious student of geography can afford to miss.

C. B. F.

Cartagena and the Banks of the Sinu.— **R. B. Cunninghame Graham.** London : W. Heinemann. 1920. Pp. 247. *15s. net.*

During the war Mr. Cunninghame Graham was sent on a mission to examine the cattle resources of the Republic of Colombia, and the present volume is an account of his travels in the province of Bolivar, to which is added some account of its history. Mr. Graham writes delightfully of this remote land, and succeeds in conveying to the reader its air of peaceful repose and calm indifference to the busy world. Of the many tasks that took men afield in war-time this must have been one of the most pleasant. Stagnant as Cartagena is to-day, Mr. Graham believes that the old walled city will one day become the chief port on that part of the Colombian coast. When the railway system is better developed the fine harbour of Cartagena, a famous rendezvous of ships in the sixteenth century, will supplant both the harbourless Barranquilla and the pier, 18 miles distant from that town, styled Puerto Colombia. The future of the province lies in cattle-breeding, to which may possibly be added mineral oil. The charm of the book is enhanced by the care the publisher has shown in the choice of paper and type, but a map would have been a useful addition.

R. B.

AUSTRALASIA AND PACIFIC ISLANDS

Some Experiences of a New Guinea Resident Magistrate.— **Captain A. W. Monckton, F.R.G.S., F.Z.S., F.R.A.I.,** sometime Official Member of Executive and Legislative Councils, Resident Magistrate for the Goldfields,

High Sheriff and High Bailiff, and Senior Officer of Armed Constabulary for H.M.'s Possession of New Guinea. *With* 37 *Illustrations and a Map.* London: John Lane. 1921. 21*s. net.*

This book is no story of a globe-trotter (well or ill trained as a snapshot observer), nor that of a leader of any of the scientific expeditions of which there have been many in recent years, nor is it the story of a student never present in the colony of which he writes, but it is the intensely interesting record of the experiences of an educated gentleman, not a specialist, but who, almost by chance, becoming first a gold-digger in New Guinea, then an island trader, eventually became a Government official, in posts of exceptional responsibility and authority, in that remote British tropical possession while it was actually in the throes of being built up into a British colony.

Captain Monckton thus had, and has excellently used, great opportunities of seeing, from the different points of view of the ruled and the ruler, the whole interesting process of development; and he has now told the story of some of his personal experiences quite simply, but in a way that makes it intensely interesting to the general reader, and at the same time of great practical use to the administrator and to the student of colonial development.

There is perhaps not much pure geography in the book, using that term in its narrowest and most technical sense. Indeed, what might perhaps have been geographically of greatest interest is dismissed in the last brief chapter of ten lines only, which explains that the writer was "off to the war," but had intended to conclude his book with a description of Mount Albert Edward and of his journey right across New Guinea, from Kaiser Wilhelm's Land to the Gulf of Papua; but he adds that "if this book proves of interest to people, and all goes well, he may write an account of these expeditions at a later date."

Naturally Captain Monckton has provided much that is of interest to the anthropologist, whose subject is so closely interwoven with that of the geographer. One such point—small but of interest in connection with a reference in a recent number of this *Journal* to Mrs. Hadfield's account of the use by the natives of the Loyalty Islands of an "artificial rat" as the bait when fishing for squids—may here be noted. Captain Monckton tells that "on a small coral island surrounded by submerged coral boulders and, but for a few stunted trees, bare of all vegetation," he saw "real rats going down to the edge of the reef—lank hungry-looking brutes they were, with pink naked tails—and that rat after rat picked a flattish lump of coral, squatted on the edge and dangled his tail in the water; suddenly one rat gave a violent leap of about a yard, and as he landed a crab was seen clinging to his tail; turning round, the rat grapped the crab and devoured it, and then returned to his stone, the while the other rats were repeating the same performance."

In connection with his pearl-fishing experiences, Captain Monckton makes some small detailed statements which may be true of the New Guinea pearl-beds, but not of those off the coast of Ceylon; *e.g.* he states that the pearls "of a very pale golden or straw colour" frequently found off the Trobriand Islands are considered as of comparatively little value; but Ceylon pearls of this colour, if put on the Indian market, are found to fetch especially high prices, owing to the predilection of the Eastern Rajahs for pearls of this quality.

Also in connection with pearl-fishing, in the book the extraordinarily tantalizing statement is made that "black-lip" shell is usually of much less value than "gold-lip"—these are the trade names of two distinct varieties of pearl oyster—but for some reason unknown to Captain Monckton, "black-lip" always jumps tremendously in price during periods of Court mourning!

One other aspect of the book demands notice even in this more or less technical *Journal:* it is more "chockful" of exciting and interesting real experiences than any boys' book of imaginary adventure that can be readily called to mind. E. IM T.

GENERAL

The Principles of Economic Geography.— R. N. Rudmose Brown. London: Pitman. 1920. Pp. xvi. + 207. *Price* 10*s.* 6*d. net.*

The most obvious comment on this book is that it is much too short to allow of an adequate treatment of the many topics it refers to. The author has attempted a survey of all the important facts and relations included under his comprehensive title, each being considered in relation to the whole world. This definitely non-regional treatment makes the book a useful complement to its companion volume in the same series, Mr. McFarlane's 'Economic Geography,' in which regional aspects are emphasized. The chapter (No. xvi.) devoted to "The Origin and Growth of Towns" is limited to six pages. In this small space Dr. Rudmose Brown has managed to mention almost all the geographical factors which affect town growth; but he has not been able to discuss any of them fully, nor to illustrate their influence by sufficient examination of particular instances. This over-condensation, combined with the absence of illustrative diagrams, makes the book rather difficult to read; but the geographer will find in it a concise summary of the topics classed under economic geography and a valuable supplement to any text-book of that subject. C. B. F.

The Atlas Geographies: III. Senior Geography. No. 2. Europe.— Thomas Franklin. Edinburgh: W. & A. K. Johnston. Pp. 148. *Price* 7*s.* 6*d. net.*

This combination of text-book and atlas in one volume has evidently met with sufficient success to justify the extension of the series. Personally we should consider an atlas still necessary, even if only to supplement the limited range of the maps given here. The text is clearly written, but it contains no special features, and repeats some common errors from older books: *e.g.* it confuses a "race" with a language group (pp. 17 and 19), and states that the N.E. Trade Winds blow over Italy and Spain in summer (pp. 58 and 65). Most of the diagram maps are overcrowded with names. On map 32 (Russia) the name Rokitno Swamp is wrongly placed; and on Map 28 there is the new spelling of Sabern for the place known to Germans as Zabern and to Frenchmen as Saverne, the last of which is now the correct spelling.

C. B. F.

THE MONTHLY RECORD

EUROPE

Magini's Map of Italy, 1608.

ONCE more comes the report of the discovery of a long lost monument of early cartography, in the form of G. A. Magini's map of Italy, brought out in 1608 after assiduous collection of material lasting through many years. That such a map existed has been known from various literary sources, but all efforts to trace it on the part of students like Antonio Favoro and Roberto Almagià had proved fruitless until about two years ago, when, guided by a hint from Prof. A. Mori, Prof. Almagià met with a copy in private ownership.

He has since described the map, with a complete reproduction on a small scale, in the Italian periodical *L'Universo* (Anno I, No. 2). Magini, the astronomer and geographer of Padua, best known perhaps from his edition of Ptolemy brought up to date first published in 1596, had even before that time begun to occupy himself with a vast cartographical work on Italy, the final outcome of which was the fine collection of special maps brought out in 1620, after his death, by his son Fabio. This atlas, a copy of which is in the society's collection, contains no modern general map of Italy as a whole, though from a letter written by Magini in 1602, as well as from the preface to his Latin editions of 'Illustrations of the Primum Mobile' in 1604 and 1606, it has been known that he had in preparation a complete map of Italy which he proposed to issue in 12 sheets. Publication was delayed by the lack of a good engraver, but in September 1608 he could write to a friend in Prague saying that it was at last ready, and according to a statement by his son in the Atlas of 1620 it was brought out in eight sheets. The copy now at last brought to light (though unfortunately somewhat damaged in places) shows that the map may be ranked with the finest cartographical productions of the sixteenth and seventeenth centuries. Including the border it measures 111·5 × 89 cms. (3 ft. 8 ins. × 2 ft. 11 ins.), and it bears the title 'Italia Nuova di Gio. Antonio Magini.' Beneath this is the dedication to Francesco Gonzaga, Duke of Mantua and Monferrat, and still lower the signature of the engraver, the Englishman Benjamin Wright, who is already known as the engraver of some of the maps in Magini's Atlas.* A notice by him near the margin of the map states that it was reduced from the original MSS. of Magini, with the omission of certain of the names. As it is, it contains a very large number, and also shows the rivers in great detail, as well as the main ranges of the Alps and Apennines. Only the north-east end of Sicily is included, but Corsica and Sardinia are given in full, and the whole of the Adriatic. Special care is given to the tracing of the political frontiers. The map marks a great advance on that of Gastaldi of 1561, the best of the sixteenth century. It was reproduced several times in the same century in the full size, and also on a reduced scale, besides being used as the basis of many of the Atlas maps of the period. Prof. Almagià promises a fuller account of the map in a forthcoming work on the whole cartographical output of Magini.

Agriculture on the Gulf of Morbihan.

Mlle. Andrée Choveaux has an instructive paper in the *Annales de Géographie* for November 1920 on the influence on the coastal tract round the Gulf of Morbihan (the "little sea") of the use for agriculture of manure derived from the sea in the form of seaweed, sea-shells, etc., valuable for their lime and phosphate content. The gulf, like other parts of the Breton coast, has a much broken outline with many small bays, points of land, and islands, with large expanses of mud exposed at low tide, and affords a striking example of the effect on economic conditions of a portion of the sea penetrating into the interior of the land. This coastal tract, in fact, forms a strongly specialized region with a breadth of 15 to 20 kilometres, differing markedly from the interior beyond that distance, the line of division being precisely that at which the use of marine manure ceases. One of the materials used, known locally as *maërl*, is a mixture of living and dead *algæ*, sand, fragments of shells and of greenish schists, the whole more or less pulverized and mixed with *débris* of

* Some account of his work is given in Sir S. Colvin's 'Early Engraving and Engravers in England' (1905).

plants and marine animals. It occurs below the limit of low tide. *Tangue* again is a mixture of carbonate of lime, clay, sand rich in quartz, felspar, and mica, phosphate and sulphate of lime in small quantities, with some organic matter. A third substance is the *goémon rouge*, consisting chiefly of *fucus*, green *algæ*, *zostera*, etc. All are eagerly collected by the inhabitants, and transported inland for a limited distance by cart or boat: the cost of more distant carriage would be prohibitive. Mlle. Choveaux shows in a sketch-map the distribution of the several kinds of cultivation on the shores of the gulf, bringing out clearly the zones determined by distance from the sea and therefore by the use of marine manure. First comes a belt of intensive wheat-culture with small areas devoted to market gardening or viticulture. The limit of this corresponds to that of the general use of the substances in question. The extreme limit of such use marks the extent of cultivation of wheat in association with rye, while beyond this rye alone is generally grown. Other crops that succeed excellently within the coastal tract are sainfoin and other trefoils, beet-root, potatoes, and vegetables of all sorts. Every possible acre of ground is utilized, the proportion of waste ground being reduced to a minimum. The paper describes the system of cultivation adopted and discusses the rural life, types of dwellings, etc. A marked feature is the excessive subdivision of property, large farms being practically unknown. Although the population is concentrated in this littoral zone, it still shows a diminution as compared with the middle of last century. Of late a certain movement towards improved agricultural development of the interior is to be noted.

ASIA

Recent Studies of the Island of Ceram.

As one of the least-known islands of the Dutch East Indies, Ceram has attracted a good deal of attention, both in Holland and elsewhere, during the past few years, and much has been done to improve our knowledge of the island. The various efforts in this direction are conveniently summarized by Jonkheer L. C. van Panhuys in the *Tijdschrift* of the Royal Netherlands Geographical Society for January 1921. In 1914, as recorded in the *Journal* (vol. 44, p. 407), the question of a thorough investigation of the island was taken up by the above-mentioned Society, and proposals were made for geological, botanical, zoological, and other studies, not only of the island itself, but of the whole tract lying between Celebes and New Guinea. About the same time investigations in Ceram were carried out by members of the "Freiburg Molucca expedition," Dr. Deninger, Herr Stresemann, and Dr. Tauern, who studied respectively the geology and morphology, natural history, and ethnology of the island; preliminary reports on the results appearing in *Petermanns Mitteilungen* in 1914 and 1915. The outbreak of the war somewhat interfered with the Dutch plans, which had to be restricted to a study of the geology, with a certain amount of natural history work by trained native collectors. A geologist, Dr. L. M. R. Rutten, was sent out in 1917 by the "Association for the promotion of the Scientific Study of the Dutch Colonies" conjointly with the Netherlands Geographical Society, and he was at work for two years in the island, sending home a series of reports which were printed from time to time in the *Tijdschrift* of the last-named Society, illustrated by coloured geological maps. The eleventh and last report appeared in the *Tijdschrift* for January 1920, in which number Dr. Rutten also gave his conclusions as to the general state of the native population and the possibilities of economic development in Ceram. At present agriculture and industries are

in a primitive state, the only products of any importance being those of the chase and fisheries, with a little sago and dammar. The standard of living is low, and much requires to be done in the way of organizing the native labour before any progress can be expected. Although the proposed topographical survey was of necessity given up by the Geographical Society in 1914, the matter was taken up by the Dutch Government, who commissioned Major F. J. P. Sachse to carry out such a survey. Work was begun in 1917 and has since been continued in the face of considerable difficulties, the map being constructed on the scale of 1/100,000. In connection with this survey new astronomical determinations of position were made at six parts of the coast by the captain and first officer of the Government steamer *Albatros*. Further contributions to a knowledge of Ceram have also been made by H. Krayer van Aalst, W. H. F. Giel, and others, several of whom have communicated papers to the Royal Netherlands Geographical Society.

AMERICA

Early French Enterprise in the Gulf of Mexico.

A little-known episode in the early colonial history of North America is the subject of a paper contributed in 1919 to the *Journal de la Société des Américanistes de Paris* by MM. De Villiers du Terrage and P. Rivet. It relates to the search in 1720–21 for the "Bay of Saint Bernard," the scene of tragic events connected with La Salle's fatal expedition in search of the Mississippi in 1684. So uncertain, at that time, was the location of this bay (the modern Matagorda bay), where the last survivors of La Salle's expedition were massacred by Indians in 1688, that no one could guess at it within a hundred leagues. After one or two abortive projects for the occupation of this bay the French Compagnie des Indes at last took definite action in 1720, and the pilot Jean Béranger sailed on August 25 in search of the Baie St. Bernard. Passing the true position of the bay (on the north-west coast of the Gulf of Mexico) Béranger reached that now known as Aransas, which he named St. Joseph after the vessel in which he sailed. During the time spent there he came in contact with a miserable tribe of Indians who used the islands which close the bay as a refuge from the stronger tribes of the mainland, and who lived almost entirely on fish and land crabs. Béranger collected a vocabulary of their language, and this, and a second brought together during the voyage of 1721, were the only practical results of the two expeditions. They are printed by the present authors from the MS. *Mémoire* of Béranger, preserved in the Archives Nationales, with a discussion of the distribution of the Indians at the time on the coast of Texas, and an attempt to assign the vocabularies to the tribes to which they belonged, their names not being recorded in the old document. The same spot saw the shipwreck, twenty-four years later, of the Chevalier Grenier, but he too fails to record the name of the tribe, which seems to correspond to the "Cujanes" and "Guapites" of the MS. map of Anglino, sixty years later (1788). The expedition of 1721 was commanded by Bénard de la Harpe, with whom went as interpreter Simars de Bellisle, known for his previous adventures and captivity among the cannibal Indians of this region. The present writers are able to supplement to some extent the account of these printed by Margry in his well-known collection. Instead of overshooting the mark as on the former occasion, the explorers of 1721 stopped short of the true position of the bay sought for, thinking that they had found it in the modern Galveston bay. The natives here (known to the French as "Caux") were much less amenable than those visited the previous year, and their threatening attitude forced La Harpe to return

without effecting anything, though he brought back an enthusiastic account of his discovery. Nine Indians were taken by force and brought to Louisiana, but ultimately escaped, and underwent miserable experiences in their attempt to return to their homes overland. The tribe was afterwards known as Orcoquizas or Orquizacos. All the Indians of these parts disappeared at the end of the eighteenth century, so that there is a certain interest in the attempt to obtain light on their former distribution from the old French chronicles. The authors find some relationship between the vocabulary obtained in 1720 and the Karankawa dialect, while that of 1721 seems to belong to the Atakapa group.

AUSTRALASIA AND PACIFIC ISLANDS

Rennell Island.

In printing the note on this island in the June number, from information supplied by Dr. Northcote Deck, we had overlooked the fact that a brief account of the island had been given by Mr. C. M. Woodford in *Man*, 1907 (No. 24), based on information collected during a visit in 1906. This account was accompanied by drawings of native tattooing and of the native method of tree-felling. Mr. Woodford, however, penetrated only 3 miles inland, and was unable to reach any native settlement, the only communication being with fishing parties on the beach ; Dr. Deck's opportunities of gaining information were therefore somewhat greater. In his paper read before this Society in 1916, on "Some little-known Polynesian settlements in the neighbourhood of the Solomon Islands" (*Journal*, July 1916), Mr. Woodford embodied some of Dr. Deck's information (with due acknowledgment), besides reproducing three of his photographs. This paper should therefore be read in conjunction with our recent note.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Glacier Observations during the War.

The fighting in the high Alps during the War in Tyrol gave occasion for a good deal of tunnelling through the snow and ice of glaciers, and the opportunity thus offered was utilized for observations of considerable interest of their inner structure and movements. Some of the lessons to be gained from these observations are summarized by R. Klebelsberg in the *Zeitschrift für Gletscherkunde* for October 1920. The operations were mainly in the region of the fields of *névé*, and much light was thrown on the various layers of which these are composed. It was somewhat surprising to find at what a small depth below the surface of the *névé* the characteristics rather to be expected at much greater depths were found. At only 3 to 4 metres the tunnels traversed firm, dark green, glacier ice, with thick layers free from included air. The dirt-bands separating the layers were very clearly marked, but passed only gradually into the clear ice, within which the finer stratification was more or less parallel to the bands. This showed an alternation of lighter and more aerated layers with those of the denser ice, and was evidently not a result of pressure but was a primary, sedimentary formation. Discordance of strata, comparable to that of rock-strata, was often observed, showing the effects of uneven melting of the surface during a period of ablation. Discordance due to the movement of the ice was also traceable, and may explain much of the observed inner structure of the ice in the lower parts of the glacicer. Much attention was given to the problem of the most suitable location for the ice-tunnels. These had frequently to be made in the neighbourhood of the Bergschrund and it was

a question how best to avoid disturbance of the passages by the motion of the ice—whether by following a line above or below the rift. It was eventually found that in the deeper layers above the latter the ice was unexpectedly firm and solid and was protected by the presence of the Schrund from the effects of the movement of the glacier. The ice was here as a rule firmly frozen to the underlying rock, which afforded nothing like a plane for the glacier to move upon. This fact, familiar to mountaineers, would seem of interest in connection with the vexed question of glacier erosion, as indicating that the "plucking" action of the ice on its bed, so often called in by American geologists as a method of erosion, may be of less importance than they suppose. Another fact noticed was the occurrence of crevasses not extending to the surface, but brought to a sudden end on reaching a plane of stratification or, more especially, of discordance. The importance of such planes in the glacier mechanism is thus brought out. Such interior crevasses may often be more lately formed than the surface layers which conceal them, the sudden formation of some being actually observed by those using the tunnels. In other cases the rifts may be older than the superjacent layers, being formed in the more rapidly moving intermediate layers between the firm ice more or less fixed to the rock-floor and the constantly renewed *névé* above. A striking example was found on the wide platform of *névé* near the summit of the Königspitze, which was cleft by an extensive crevasse near the crest which determined the flow of the ice in two directions. This is described in detail with the aid of a sketch-plan. The paper also discusses fully the remarkable ice-formations—pillars, icicles, and various crystallization-forms—which line the interior of cavities, and traces the plastic deformations which they undergo as the result of the motion of the glacier. They show how extraordinarily slow and regular the movement may be in the neighbourhood of the Bergschrund, though this is also liable to sudden and violent changes.

OBITUARY

Alexander Mitchell Kellas, D.Sc. (Lond.), Ph.D. (Heidelberg).

THE brief circumstances of Dr. Kellas' death at the outset of the Mount Everest Expedition are narrated elsewhere in this number of the *Journal*, and at the time of writing no details have come from Tibet. We cannot yet relate, and indeed may never know, the story of his exploits on Narsingh and Kabru this spring, nor is it possible to attempt here any serious appreciation of his merit as a mountaineer in the technical sense. Probably he was no great mountain gymnast, and certainly he was much more interested in the view from the summit than in the details of the ascent. He was in fact much more than a climber: a mountain geographer and a mountain physiologist, equally keen on unravelling the topography of inaccessible Himalayan groups, and on disentangling the causes of failure from sickness at high altitudes. His name has been prominent of late years on the latter side: two first-rate papers published in the *Journal* discuss all that is known of mountain sickness and lassitude in practice, and what may be learned from laboratory investigation and experiments in pressure chambers. These researches at low pressure in the laboratory were made in collaboration with Prof. Haldane, and with the support of the Oxygen Research Committee, who supplied much of the apparatus that he took to Kamet last autumn, and to Tibet this summer.

This laboratory work engaged him during his scanty leisure in the years of war, and very much of it was of immediate interest to the physiologists advising the Air Ministry. Indeed, it may have been more immediately applicable to the case of a pilot suddenly carried to a great height than to the mountaineer doing hard physical work and getting gradually acclimatized. That was the question we expected to see answered by Dr. Kellas on Mount Everest; and his death is a sad loss to scientific inquiry. In his long experience as lecturer in chemistry at the Middlesex Hospital Medical School he had gained an unrivalled knowledge of the underlying theory, and great experimental skill, which can be combined very rarely with the enterprise and courage of a bold mountaineer.

His papers in the *Alpine Journal* exhibit these qualities allied with a shrewd philosophy and an engaging modesty. On his third expedition to the Himalaya in 1911 (*Alpine Journal*, May 1912) he spent from April 24 to the beginning of September in the field, climbed Chumiomo and Pawhunri, with several lesser peaks above 20,000 feet, investigated many passes, and proved to the hilt that a single European with a few carefully trained Sherpa Bhotias can do a surprising amount of work at a very moderate cost.

"Mountaineering," declared Dr. Kellas, "is the most philosophical sport in the world." This important truth he elaborated in the *Alpine Journal* for May 1913, in a paper describing a fourth journey in the Sikhim Himalaya and the ascent of the Kangchenjhau. His adventures included an unpremeditated glissade of over 1000 feet, in the course of which he "carefully noted every thought . . . however trivial," and describes them as "of very mild scientific interest." We hope that our readers will do homage to his memory by reading these two papers, which reveal the man remarkably: his indomitable keenness and intense enthusiasm for unravelling mountain topography; his firm belief in the virtues of his coolies, and readiness to ascribe any failure to his own imperfect instructions; his modest philosophizing on success and failure; with keen observation of every feature of the country.

In 1914 he was again in the Himalaya at the outbreak of war, but has, we think, given no account of his interrupted journey. The following years were spent in the laboratory work mentioned above. In 1919 he felt severely the strain of the preceding years, and a breakdown in health compelled him to resign his lectureship in London and return to his home in Aberdeen. To the surprise of his friends, who feared his breakdown was serious, he recovered so rapidly that in April 1920 he set off again for the Himalaya, making the attempt on Kamet recently described in these pages, and in December photographing from near the Kang La the peaks north of Everest that so greatly concerned the plans of the present expedition. When the organization of the Mount Everest party was rather suddenly undertaken this spring, Dr. Kellas was invited by cablegram to join. He was nearly fifty-three, but his record made it impossible to overlook his claims to be of the mountain party, and many of us believed that he would go the furthest. He entered with energy into the task of collecting and training the Sherpa Bhotias he knew so well, and had made into such fine mountaineers. While the Mount Everest Expedition was gradually assembling at Darjeeling he was away climbing Narsingh and making a prolonged attempt on Kabru. He gave himself only a week to rest and prepare for the start into Tibet: and the sad result of his excessive zeal we have now to deplore.

In writing to Prof. Norman Collie the evening before he started on his last journey, Dr. Kellas enclosed some excellent photographs, with a very brief account of his recent work, and some penetrating notes on the vexed question

JANNU AND THE YALUNG GLACIER FROM SUMMIT OF PEAK NORTH-WEST OF THE KANG LA NANGMA

Phot. by Dr. Kellas, Dec. 1920.

PANDIM, TINGCHINGKANG, AND JUBONU FROM THE SUMMIT OF NARSINGH

Phot. by Dr. Kellas, April 1921.

whether Graham could have ascended Kabru. We hope to deal with these later. Meanwhile, by kind permission of Prof. Collie, we reproduce two of the photographs as a slight memorial of his enterprise: a view taken in December 1920 from the peak north-west of the Kang La, and the view from the summit of Narsingh early in April: two first ascents that are remarkable for the season in which they were undertaken.

A great mountaineer and an excellent friend lies buried at Kampa Dzong in sight of the great mountain he had hoped to climb. May the party that has gone forward without him be able to leave him word on their homeward passage of the success which he deserved so well to share!

PANDIM, TINGCHINGKANG, AND JUBONU FROM THE SUMMIT OF NARSINGH
Phot. by Dr. Kellas, April 1921.

Prof. A. G. Nathorst.

A well-known scientific investigator and Polar explorer has passed away in the person of Prof. Alfred Gabriel Nathorst, a Superintendent at the Natural History Museum at Stockholm, who died in that city after a long illness on 20 January 1921, aged seventy years. Like his compatriot Dr. Otto Nordenskjöld, Nathorst was a worthy successor of the Swedish pioneers in polar research, Otto Torrell and Baron A. E. Nordenskiöld, to whose work in Spitsbergen he was able to make valuable additions during his expedition in the *Antarctic* in 1898. He had been deeply interested in the tragic fate of his countryman Andrée, and during a circumnavigation of Spitsbergen he kept a sharp look-out for floats set adrift by him or any other possible means of throwing light on his fate, besides making scientific observations of all kinds. The more special work of the expedition was the exploration, for the first time, of the group known as the Kung Karl (King Charles) islands, while the nature and exact position of White island were also determined. An account of the expedition was given by Dr. Nathorst in the *Journal* for July and August 1899. In that year he sailed for the north-east coast of Greenland, again with a view to searching for traces of Andrée, as well as scientific investigations. The chief geographical results were the thorough examination of Franz Josef and King Oscar fiords between 72° and 74° N. and their many ramifications, the results being put before the readers of this *Journal* in January 1901. These two expeditions were fully described in Prof. Nathorst's book, 'Två Somrar i Norra Ishafvet, published in Stockholm in two volumes in 1901 (see review in *G.J.*, January 1902), and rich in instructive observations of all kinds. The subjects which interested him most were geology and botany (especially the botany of early geologic periods) and he was responsible for a large number of memoirs on the contributions of polar explorers to these subjects—Nansen's, Sverdrup's, etc., as well as his own. He was awarded the Cuthbert Peek Grant of this Society in 1899.

Rev. T. T. Norgate.

We much regret to record the death of the Rev. Theodore Tracey Norgate, a Fellow of the Society since 1905, and well known as a popular lecturer on various out-of-the-way corners of Europe, with which he had made himself familiar during his somewhat adventurous wanderings. Mr. Norgate was only fifty-three at the time of his death early in May. He had been unwell for some time, and had gone down into Devonshire to recruit, but died of heart failure at Stoke Fleming on May 4. He was the grandson of the late Canon Norgate and second son of Mr. C. B. Le Grys Norgate of East Dereham. Going when quite young to Canada, he had a distinguished career at Toronto University, was ordained, and held a curacy at Toronto Cathedral. Returning to England,

he was ordained priest by the present Archbishop of Canterbury and held curacies at Northfleet and Beckenham. His most important work had been done as Secretary of the Incorporated Church Building Society, a post which he took up in 1910. His travels had taken him into most of the European countries, and he had lectured on Russia, the Carpathians, Montenegro and other countries east of the Adriatic, Corsica, Andorra, Sicily, San Marino, besides France, Tyrol, etc., paying special attention to their peoples and historical associations. During the war he lectured also on the theatres of operations in the east and west, illustrating the events from his stores of personal knowledge aided by photographs and maps. He had several times given one of the Christmas lectures at this Society.

CORRESPONDENCE

Stone Circles in Gambia.

THE interesting point concerning stone circles raised by Mr. H. St. J. B. Philby in his paper at the Meeting of the Society on 3 May 1920, and the remarks of Mr. Hogarth in the course of the subsequent discussion (*G. J.*, 56, pp. 447, 463–4), reminds me of the groups of stone circles to be found in parts of the Gambia Protectorate.

At Tento, in Upper Salum, roughly 13° 46′ N., 15° 7′ W., several groups, each consisting of from eleven to fifteen cylindrically-shaped shafts of ironstone, are in existence, mostly isolated from the neighbouring villages. The appearance and design of the stones would suggest that in turning, shaping, and polishing the architects used pulveral processes of workmanship. In some groups will be found a "master" stone in the direction of the Qibla, which reminds one of the Mâliki Law providing that, when several corpses are placed in the same grave, the corpse of the individual who enjoyed the highest consideration should be given the first place: that is, on the side facing Mecca.

The Tukulors of Upper Salum, as also those of Jalo Kunda in Lower Niani and Niani Maro in Nianija, show a singular indifference to the origin, tradition, and significance of these groups of stone circles. Perhaps further investigation will reveal something of their history.*

L. A. W. BROOK, Major, late R.F.A.

Touray Kunda, Lower Salum,
MacCarthy Island Province, Gambia Protectorate.
17 April 1921.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1920–1921

Anniversary General Meeting, 30 May 1921.—The President, Lieut.-Colonel Sir Francis Younghusband, in the Chair.

The Hon. SECRETARY (Mr. A. P. Maudslay) read the Minutes of the Anniversary Meeting held on 31 May 1920.

The PRESIDENT: Our next business is the presentation of the Royal Medals

* In the *Journal* for November 1898 (12, 522), Captain Carroll gave a short account of similar circles at Lamin Koto and Chamen, with plans and a photograph.—ED. *G.J.*

and Awards. The first presentation is the Patron's Medal to General Bourgeois.

General Bourgeois, your services have been long known to us in this Society, for it is many years since you made your expedition to Ecuador to re-measure with greater accuracy the arc of meridian, so that we might have a more precise knowledge of the figure of the Earth. Since then you have held with great distinction the high office of Chief of the Geographical Service of the French Army; and the triangulation of France, and the new topographical map of France on the scale of 1 : 50,000, are sufficient evidence of the high distinction to which you have raised that service. You also presided with great skill and marked discretion and tact over the general conference on the map of 1/M. And during the war you won, in a very special degree, the scientific admiration of our survey officers in France in the great work which you and they contributed to the geographical service of the Allies. For all these services to Geography and Geodesy the Council of the Royal Geographical Society recommended to His Majesty that he should be pleased to award his Royal Medal to you, and I have now the great pleasure and honour of handing the Medal.

General BOURGEOIS: Je ne saurais dire combien j'ai été touché et infiniment honoré quand j'ai appris que sa Majesté le Roi, Patron de la Royal Geographical Society, avait donné son approbation à la proposition qui lui avait été faite de me décerner la Médaille du Patron de votre Société. J'y ai vu non seulement une marque d'estime qui allait à ma personne, à mes travaux, à la part que j'ai pu prendre pendant toute ma carrière de Directeur du Service Géographique de l'Armée, à de grandes expéditions géodésiques, topographiques et géographiques, aux travaux cartographiques de la carte au millionième, mais j'y ai vu aussi un haut témoignage de sympathie donné à celui qui, en collaboration si intime, si continuelle et si toujours cordiale avec les services cartographiques de la Grande-Bretagne, avec ses amis les directeurs et les chefs de ces services, avait pu contribuer avec eux pendant la guerre à assurer à nos armées alliées, tout ce dont elles avaient eu besoin dans le domaine si vaste, et qui de jour en jour devenait plus vaste encore, de la cartographie militaire. Du reste, les relations entre géodésiens de France et de Grande-Bretagne remontent à bien des années, et comme ancien Chef de la section de géodésie du Service Géographique de l'Armée, avant d'en avoir été le Directeur, je ne saurais oublier que c'est en 1864 que les géodésiens des deux pays ont établi la jonction des triangulations de nos deux pays par-dessus le détroit, ce qui a été comme un premier symbole de la jonction plus intime encore qui devait nous unir. Depuis cette année de 1864, nous avons fait en commun plusieurs grandes déterminations astronomiques ou géodésiques. Nous nous sommes rencontrés périodiquement dans les conférences de l'Association Géodésique Internationale, et dans ces réunions, toujours unis, voyant toujours la science avec le même esprit clair et simple qui est la caractéristique de la mentalité scientifique de nos deux pays, nous avons, en commun, largement contribué aux progrès de la géographie mathématique.

Monsieur le Président, c'est en me rappelant tous ces souvenirs qui nous unissent, que je vous prie, comme Président de la Royal Geographical Society, d'être mon interprète auprès de tous ses Membres, pour la remercier tout d'abord d'avoir bien voulu me faire l'honneur de me nommer en 1918 Correspondant Honoraire de la Society et ensuite de m'avoir fait un honneur plus grand encore en me décernant la Médaille du Patron que je suis on ne peut plus fier de recevoir de vos mains.

The PRESIDENT: The Founder's Medal this year is awarded to Mr. Stefansson. Unfortunately, he is not able to be present here this afternoon. Mr. Stefansson, in the years 1908–12, made some remarkable journeys on the northern shores of Canada and Alaska, and proved the very interesting point that it was possible for Arctic explorers to live on the resources of the land. In the year 1913 he was placed by the Canadian Government in charge of the Canadian Arctic Expedition, whose object it was to explore the unknown Arctic archipelago on the north of Canada. During the course of that expedition he was unfortunate enough to lose his ship the *Karluk*, with some of his scientific staff and much of his stores, but in spite of this loss he was able to conduct a very valuable exploration of the archipelago, and on account of the valuable work which he did he received the thanks of the Canadian Privy Council. It is a matter of great regret that he is not here this afternoon to receive his Medal; but I shall have pleasure in handing it to the High Commissioner and asking him to transmit it to Mr. Stefansson. I may add that at the suggestion of His Majesty the recipients of the Gold Medals are given the choice (a custom continued since the war) of having the medal either in gold or bronze, and if they choose to have it in bronze, that they should have the difference in money. Mr. Stefansson has asked us to give the difference in value between the Bronze and Gold Medal to Mrs. Murray, the widow of one of his scientific staff who unfortunately lost his life during the expedition. I have now the pleasure to hand to you, Sir George Perley, the Medal for transmission to Mr. Stefansson.

The High Commissioner for Canada (Sir GEORGE PERLEY): On behalf of Mr. Stefansson I want to express as strongly as I can his great appreciation of the honour which this well-known Society has paid to him in giving him the Founder's Medal this year. I may also say, on my own behalf and on behalf of the Canadian Government which I represent in this country, that we are very grateful and very glad that this Society has seen fit to award this Medal to Mr. Stefansson, because we feel he has rendered great service during this expedition in the Arctic, not only to science, but also to Canada and the British Empire, in bringing us back so much valuable information regarding our possessions in those Arctic seas. I may say, Mr. President, that I regret exceedingly that Mr. Stefansson could not have been here himself, because I know receiving this Medal at your hands would have doubled his pleasure in having had it awarded to him by the Society. I am having to do this for him. Perhaps I may be permitted to say that as Mr. Stefansson is not here himself it is rather appropriate that I should receive the medal for him, because as a member of our Government I was the one who made the arrangements with Mr. Stefansson in 1913 under which this expedition was started. With regard to the money (the cheque for which I have here), which Mr. Stefansson wishes given to Mrs. Murray, the widow of the oceanographer who went with him, it simply shows in another way the kindness and consideration he always had for his staff and other members of the expedition. So I thank you very much, on behalf of Mr. Stefansson, the Canadian Government and myself, for awarding this medal, which I am only too delighted to forward to Mr. Stefansson, and I shall also see that Mrs. Murray gets the cheque.

The PRESIDENT: The next award is the Murchison Grant to Commandant Maury.

You have, Commandant, for many years been well known to our officers in East Africa for the skill which you have shown during the conduct of the survey operations on the frontier between Uganda and the Belgian Congo. They especially admired the fine work which you had done in the Congo area,

for you surmounted the physical difficulties of that area with resolution and skill, and made a triangulation of it which was of the greatest use to the Belgians and ourselves during the operations of the recent war. I have therefore very great pleasure in handing to you the Murchison Grant, which, at your own wish, takes the form of a watch.

Commandant Maury, speaking in French, thanked the President and Council for the award.

The PRESIDENT: The Back Grant has been awarded to Miss Marion Newbigin for her many writings on geographical subjects, and especially those dealing with the nationalities of the Balkans. Miss Newbigin is also the editor of the *Scottish Geographical Magazine*, and for these services to geography we have this year awarded to her the Back Grant. She is unfortunately not present this afternoon, but I hand it to Mr. Maudslay to convey to her.

The PRESIDENT: The Cuthbert Peek Grant is awarded to Captain Noel. Captain Noel, despite great physical and political difficulties, conducted a reconnaissance in the year 1913 into Tibet, in the direction of Mount Everest, and reached as far as was possible in those days before we got permission of the Tibetan Government to explore that mountain. Since then he has travelled in the Caspian provinces of Persia, and on both these journeys he has taken valuable photographs, showing his skill as a photographer, and in that way adding much to our knowledge of the countries through which he travelled. I have much pleasure in handing to you the Back Grant.

Captain J. B. L. NOEL: I thank you very much indeed, and ask you to convey my thanks to the Council of the Society for the award which you have given me. I myself really feel that I have no claim to this award, because I am not a scientific traveller like the other recipients of the awards to-day. I travel only for the fun of it. One can spend spare time in journeys in various parts of the world, as I have done in Tibet and Persia, for the purpose merely of photographing; but that is not very scientific. The work I did towards Everest was really very small, as I only got a few miles over the frontier; but it was very interesting to me, and this award will be a very great encouragement to further work.

The PRESIDENT: The Gill Memorial has been awarded this year to Colonel MacLeod. During the war he was in command of a Survey Battalion which was, perhaps, better equipped than any other for making maps from air photographs, and he, by his skill and resource, successfully developed this new method of map-making, and on that account we have given him this award. Colonel MacLeod was also instrumental in starting the work at the Royal Geographical Society upon the provisional 1/M map carried out there during the war. On these accounts we give you, Colonel MacLeod, the Gill Memorial, which was founded in memory of Captain Gill who belonged to your own corps.

Colonel M. N. MACLEOD: I do not know whether those present assumed from what the President said that I was the sole person, or the leading person, in the development of the method of survey from aeroplane photography. I had something to do with it, and it fell to me because I was up with the Army of the Rhine, and exceptionally favourably placed for the purpose, to carry out investigations into the theory of the work; nevertheless I did not really do very much more than build on foundations laid by others—Colonel Winterbotham, officers of the Service Géographique, officers of my own Battalion, and many others, all of whom contributed to complete my knowledge, and I only added my contribution to theirs. I would like to say, however, how much

I appreciate this award. My work was, to a large extent, a labour of love. I was interested in it, and it never entered my head it would be considered of sufficient importance to earn for me an award of any kind from this Society. That adds certainly to my own appreciation of it.

The President then delivered his Anniversary Address, which is printed on p. 1.

The President appointed Mr. Osward Cattley and Mr. John Bolton to be scrutineers of the ballot.

The Annual Report of the Council with the Auditors' Report and the Accounts for 1920 were presented to the Meeting, and were discussed.

The PRESIDENT: Last Monday, when Mrs. Rosita Forbes gave a lecture to the Society, it was very unfortunately the case that a great number of Fellows and their friends were unable to gain admittance. The Council very much regret that, and I should like to explain to Fellows one of the reasons for it. It is very difficult for us, when we secure this hall for the season, to know exactly when there is going to be a very popular lecture. We have to engage this hall almost a year in advance or we should not get any hall at all, and we have looked all over London for a hall of about the size we require. Unfortunately there are not a very large number available. This hall seemed to be on the whole the best. During last session it was never overcrowded, and there was never an occasion on which Fellows were not able to get seats. But apparently the lectures this session have been more popular, and on two occasions, at General Dunsterville's lecture and at Mrs. Forbes's lecture, there were many Fellows who could not gain admission. To overcome the disappointment of Fellows I asked Mrs. Forbes if she would repeat her lecture. She most kindly agreed to repeat it, but at the same time she brought to my notice the fact that she was giving another lecture on June 2. She said she was very occupied at the present time correcting proofs of her book and learning Turkish for another journey she was to undertake almost immediately. I did not therefore press her, but we shall be glad to take tickets for Fellows who could not gain admission at Mrs. Forbes's previous lecture at her lecture on the 2nd. As regards the arrangements for next session we will try and anticipate when there is likely to be a crowded meeting, and we are reserving one date, April 24, on which we will secure the Queen's Hall or Central Hall, for what we think will be an unusually popular lecture. It is difficult to know which lectures are going to be popular, and at the last moment it is impossible to secure any big hall in London. But I should like Fellows to be assured that we shall do our best to meet their convenience.

The Meeting proceeded to the election by ballot of the President and Council for the ensuing year (see p. iv.).

Mr. P. Y. Alexander proposed that the thanks of the Society be given to the Officers and Members of Council who retire at the end of the session, and this was carried by acclamation.